MAY 0 6 2004
PATENT & TRADEMARK OFFICE
OIPE

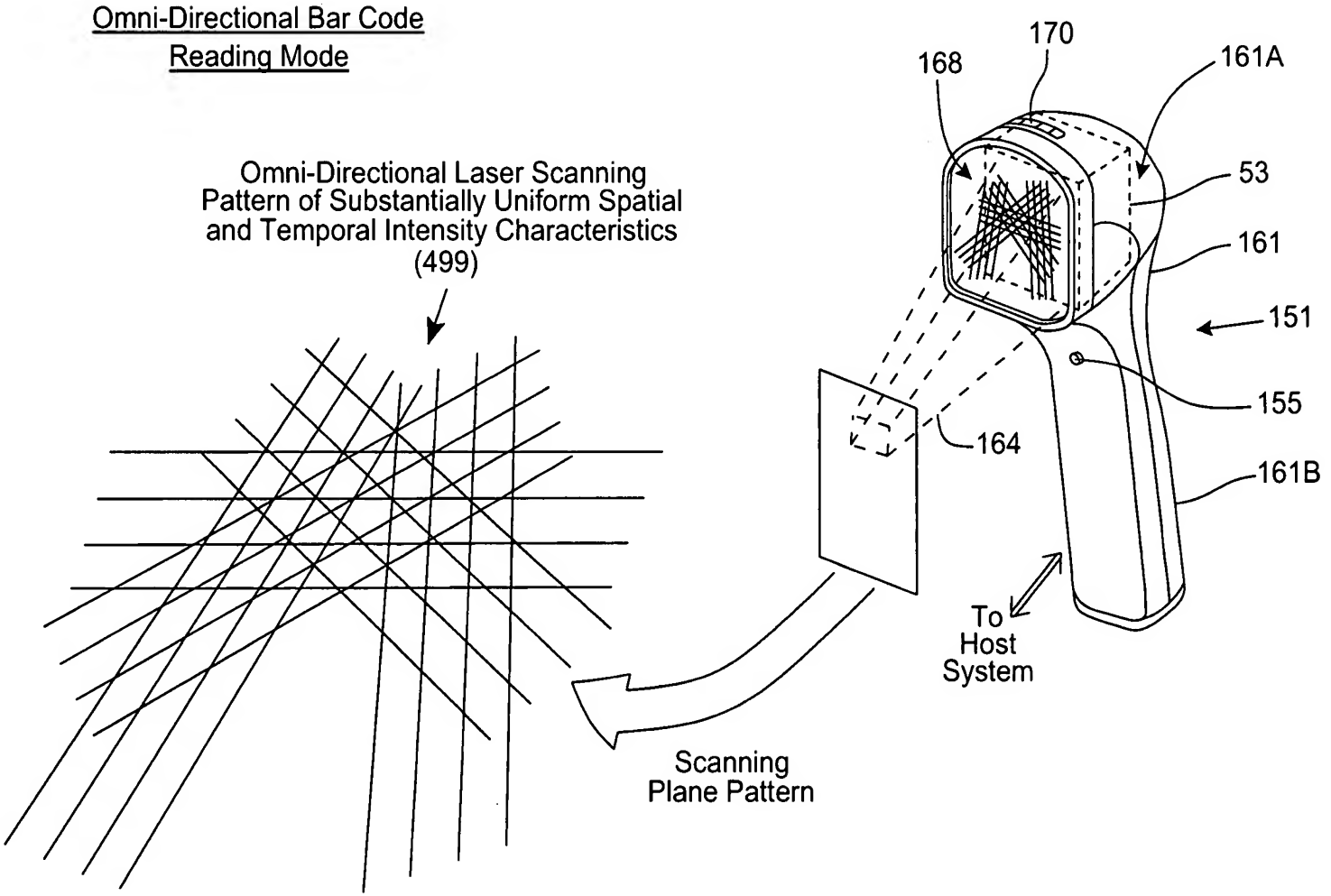

FIG. 1A

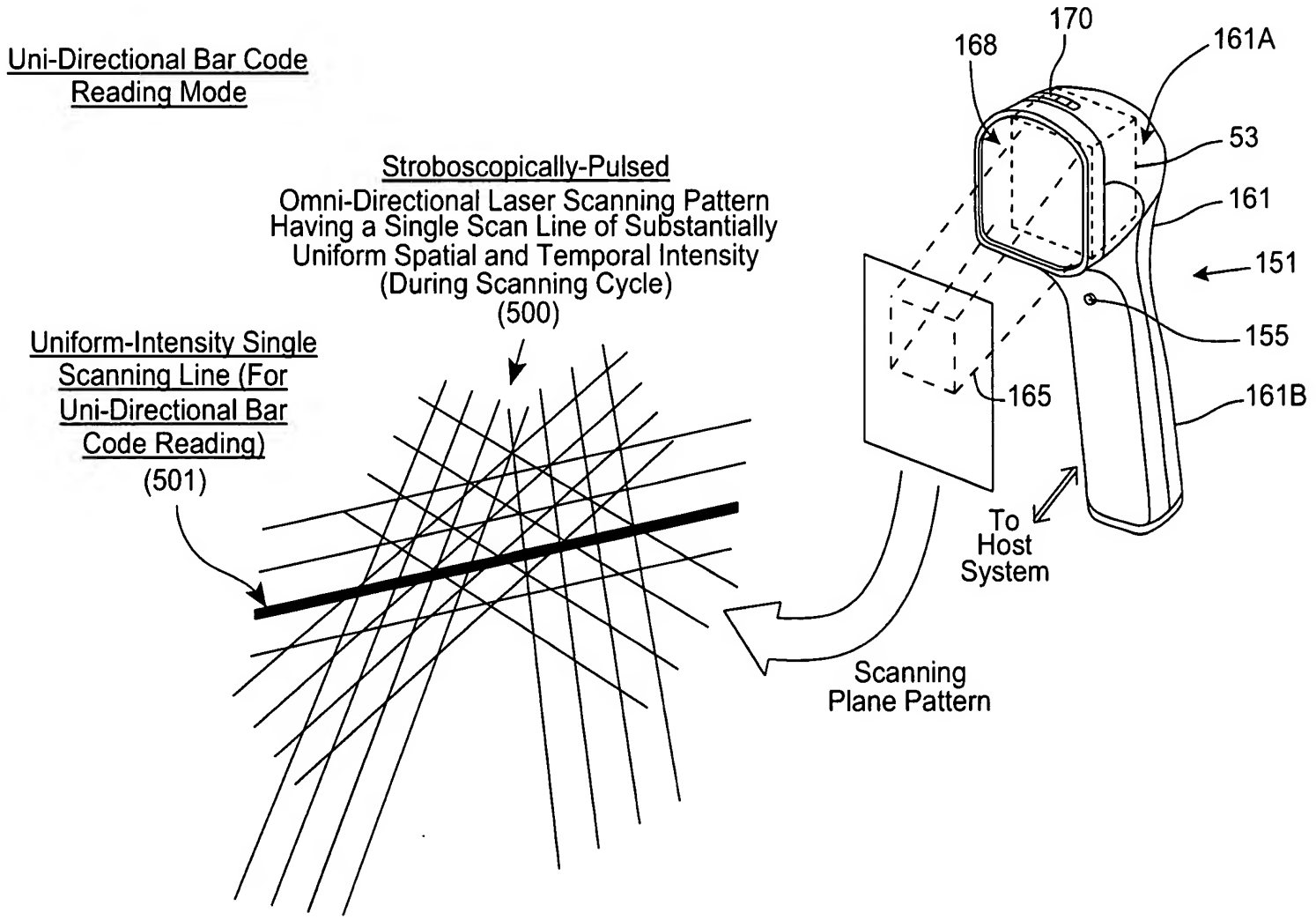
Uni-Directional Bar Code Reading Mode
Stroboscopically-Pulsed Omni-Directional Laser Scanning Pattern Having a Single Scan Line of Substantially Uniform Spatial and Temporal Intensity (During Scanning Cycle) (500)
Uniform-Intensity Single Scanning Line (For Uni-Directional Bar Code Reading) (501)
168
170
161A
53
161
151
155
165
161B
To Host System
Scanning Plane Pattern

FIG. 1B

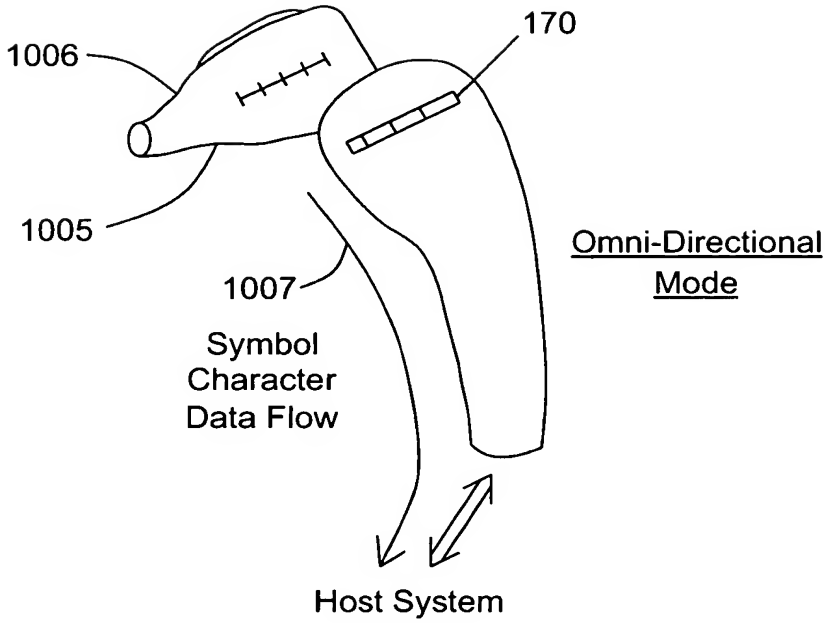
1006
170
1005
1007
Omni-Directional
Mode
Symbol
Character
Data Flow
Host System

FIG. 2A

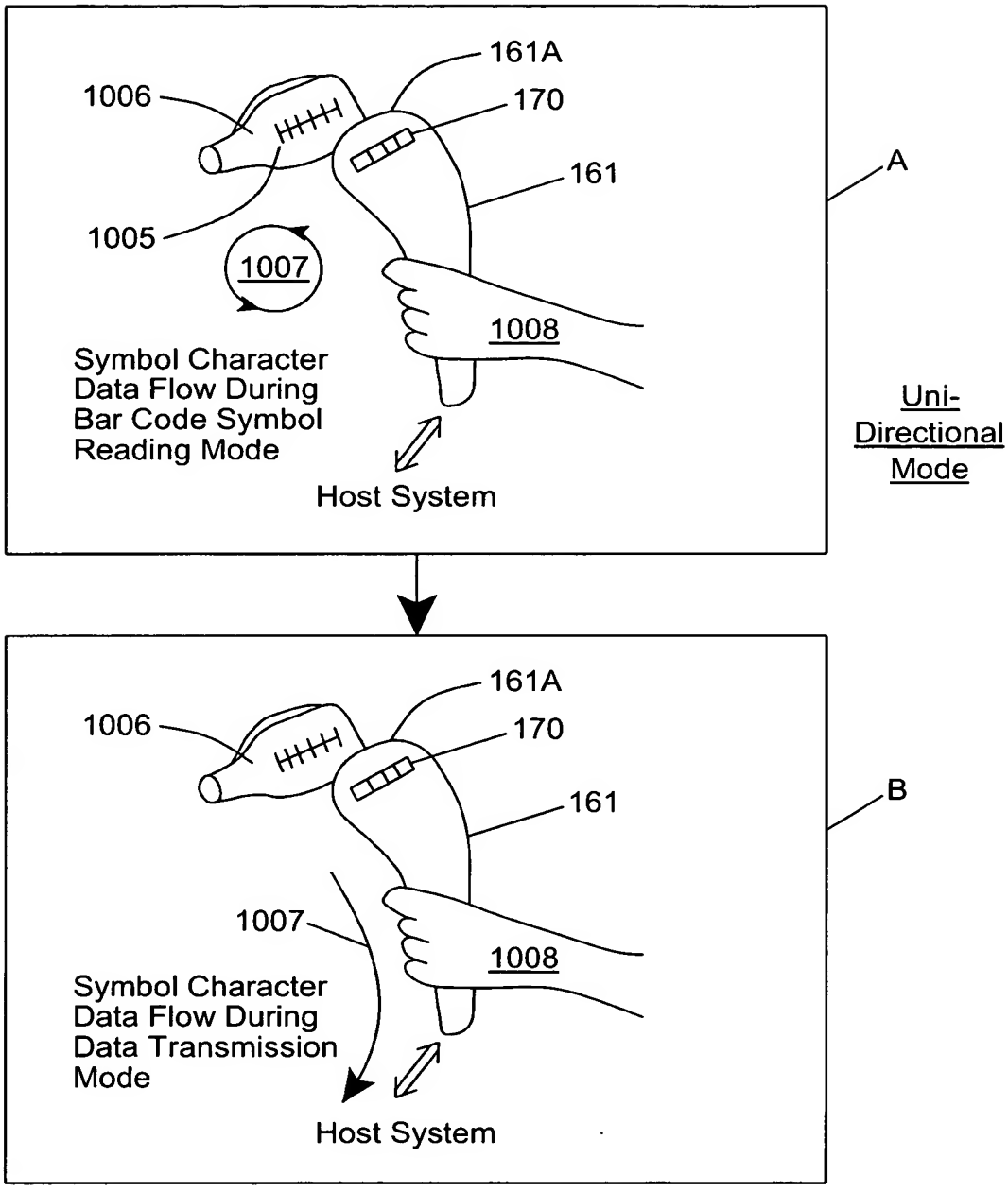
161A
1006
170
161
A
1005
1007
1008
Symbol Character
Data Flow During
Bar Code Symbol
Reading Mode
Host System
Uni-
Directional
Mode
161A
1006
170
161
B
1007
1008
Symbol Character
Data Flow During
Data Transmission
Mode
Host System

FIG. 2B

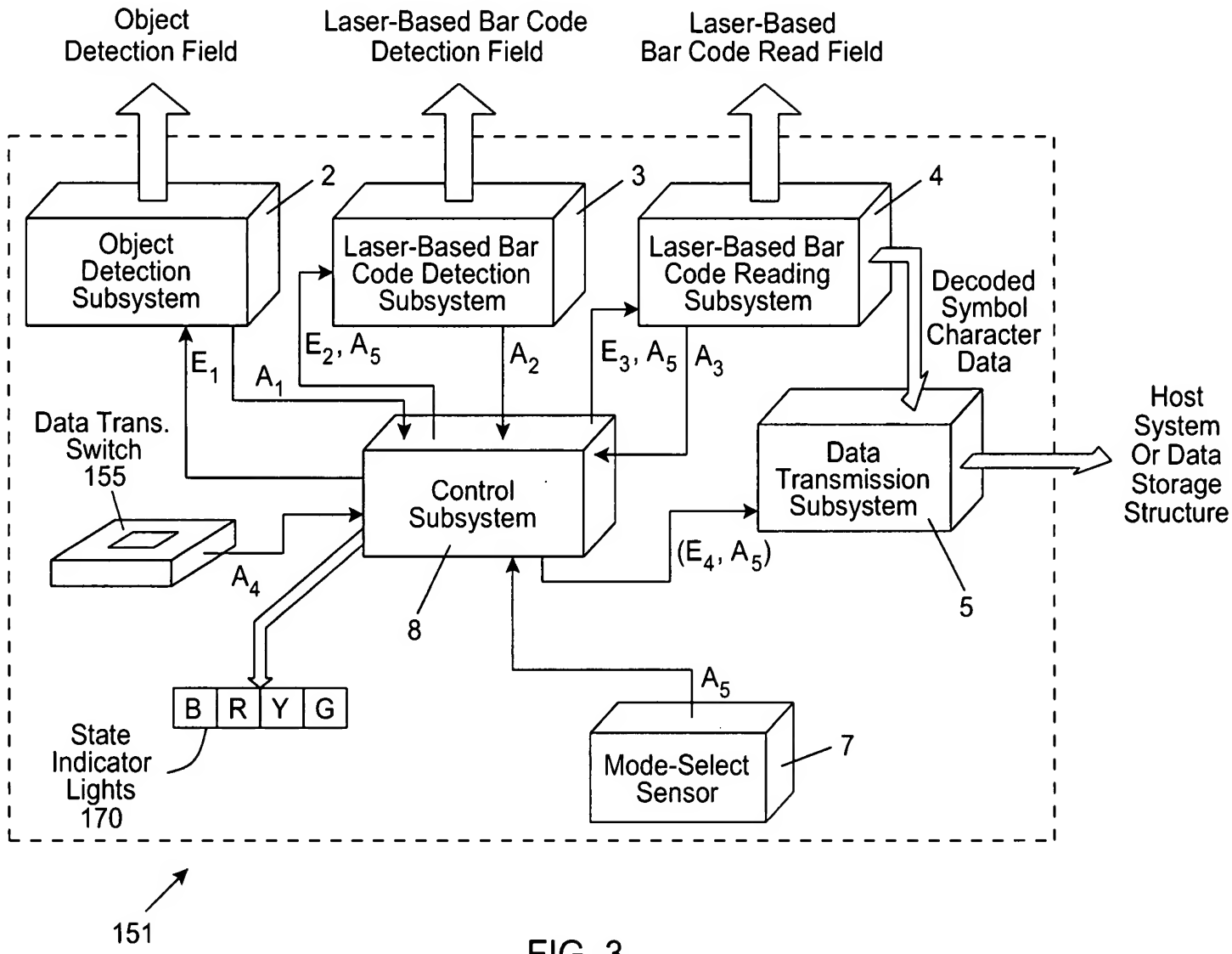
Object Detection Field
Laser-Based Bar Code Detection Field
Laser-Based Bar Code Read Field
Object Detection Subsystem
2
Laser-Based Bar Code Detection Subsystem
3
Laser-Based Bar Code Reading Subsystem
4
Decoded Symbol Character Data
E_1
A_1
E_2, A_5
A_2
E_3, A_5
A_3
Data Trans. Switch 155
Control Subsystem
Data Transmission Subsystem
Host System Or Data Storage Structure
A_4
(E_4, A_5)
8
5
A_5
B R Y G
State Indicator Lights 170
Mode-Select Sensor
7
151

FIG. 3

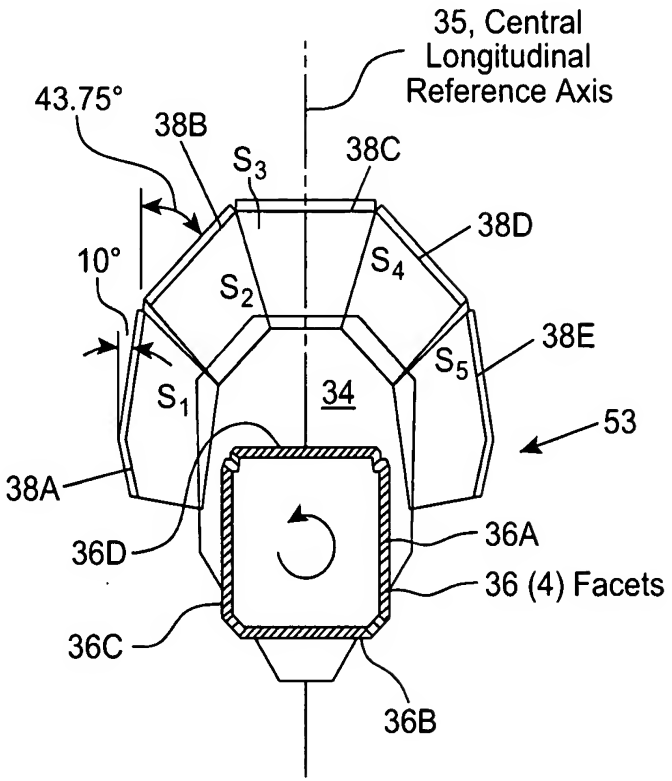

FIG. 4A

	Twist α	Bend θ
S_{1-5}	10°	46.0°
S_{2-4}	43.75°	42.5°
S_3	90°	40.5°

FIG. 5B

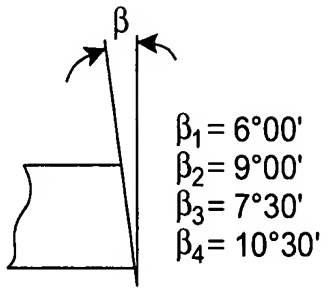

FIG. 5A

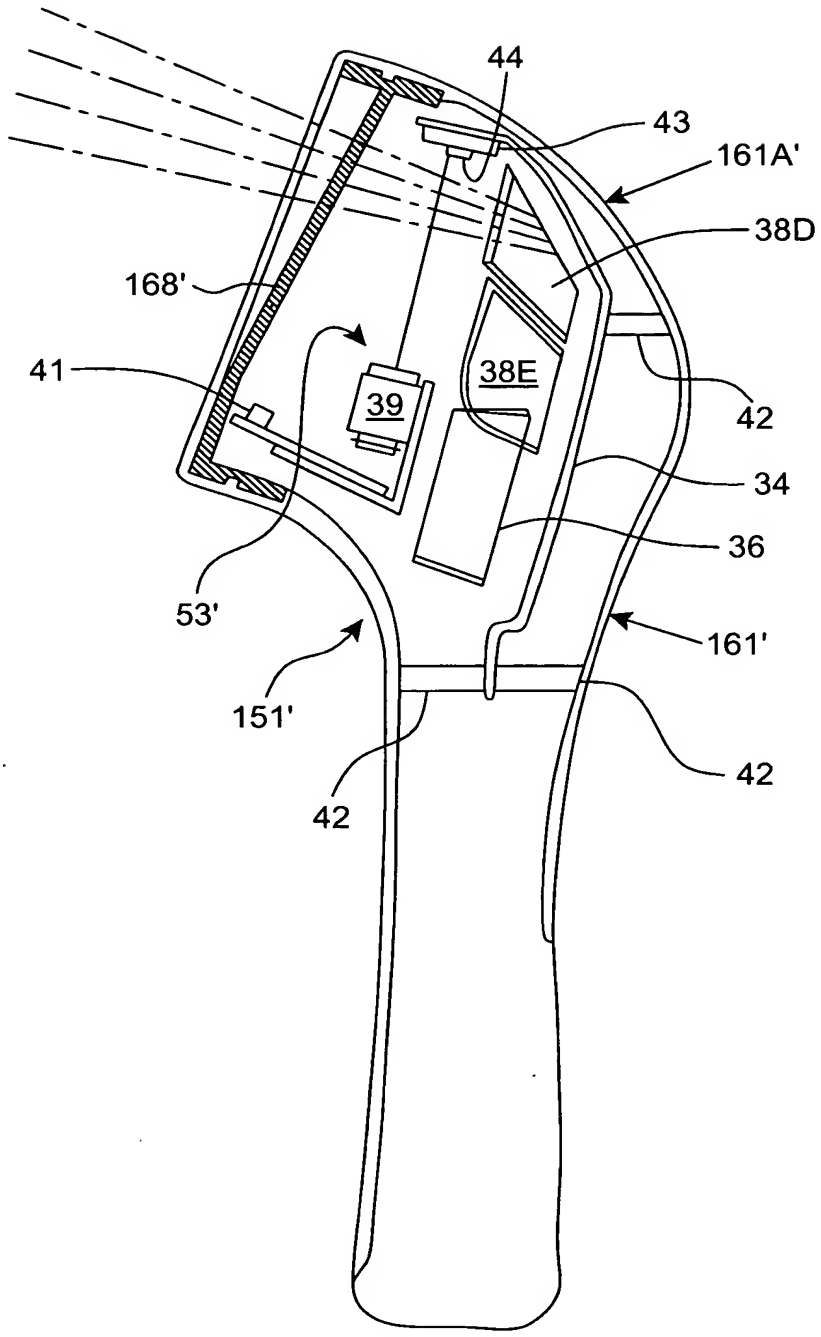

FIG. 4B

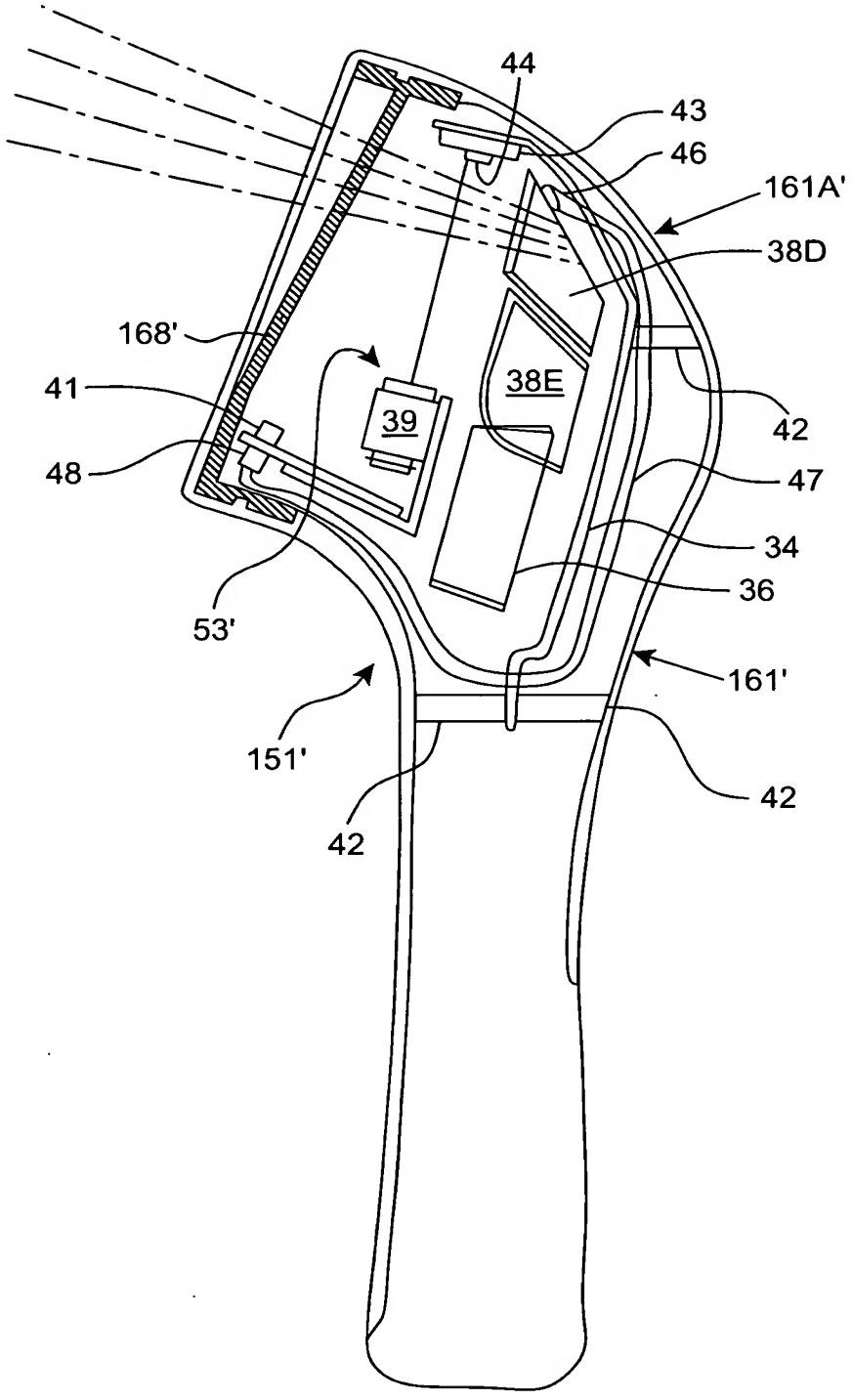

FIG. 4C

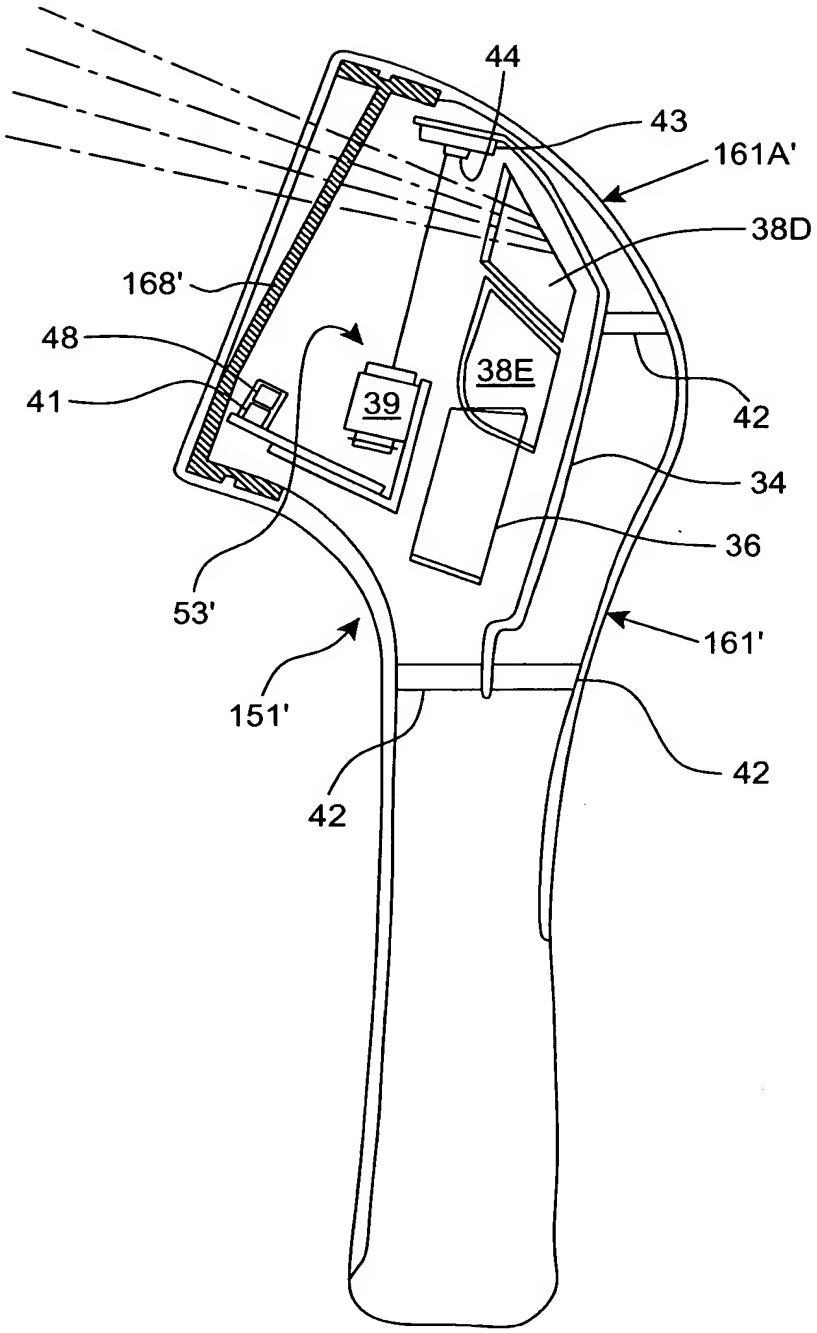

FIG. 4D1

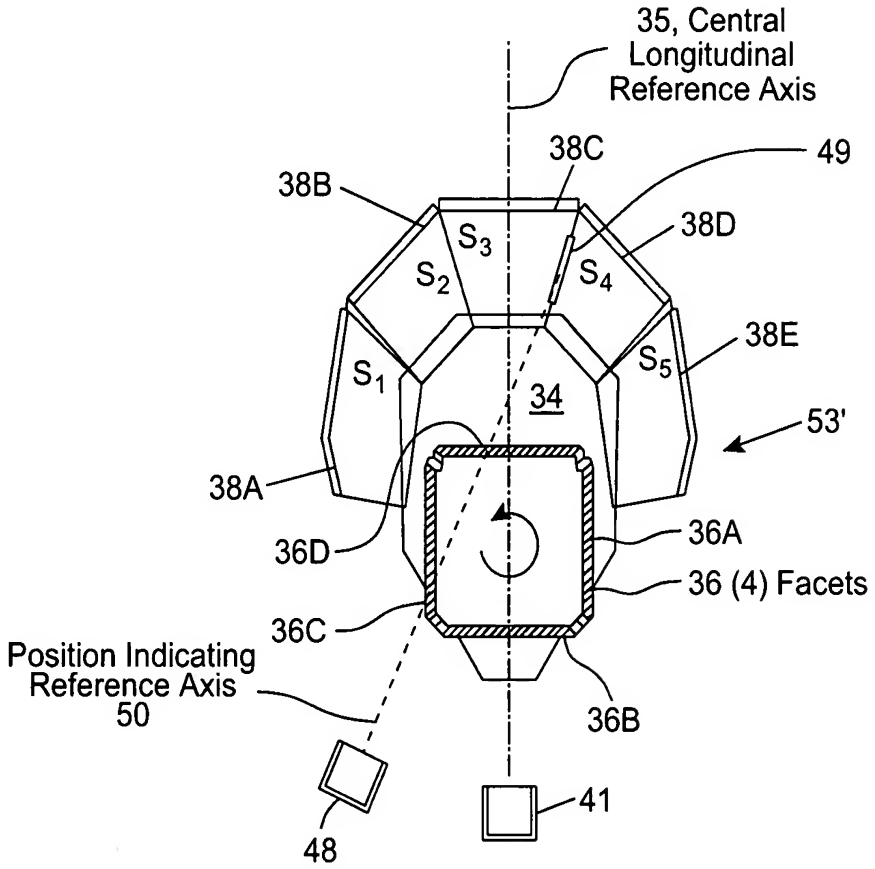
35, Central
Longitudinal
Reference Axis
38C
49
38B
38D
S_3
S_2
S_4
38E
S_1
S_5
34
53'
38A
36D
36A
36 (4) Facets
36C
Position Indicating
Reference Axis
50
36B
41
48

FIG. 4D2

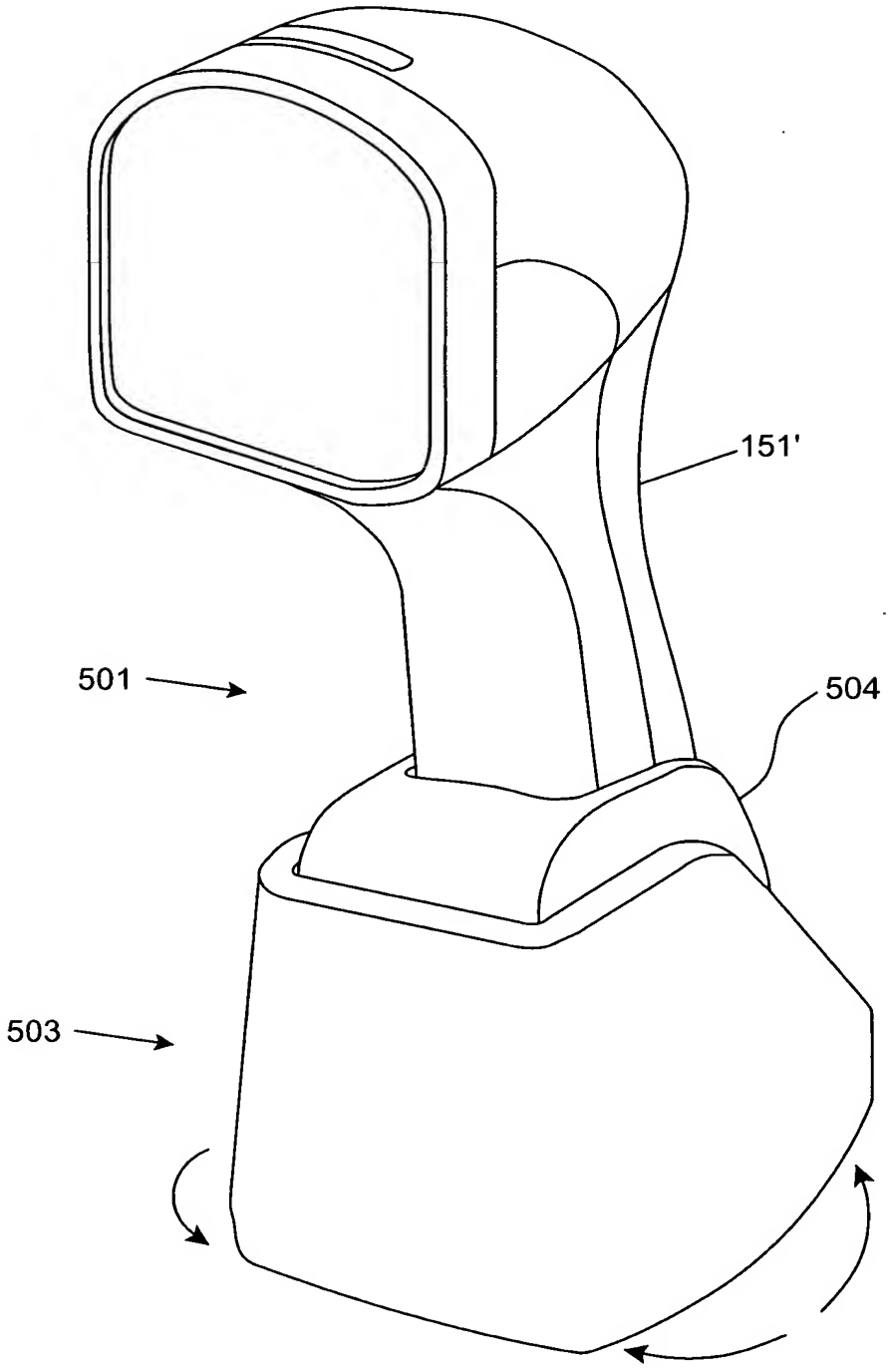

FIG. 5A

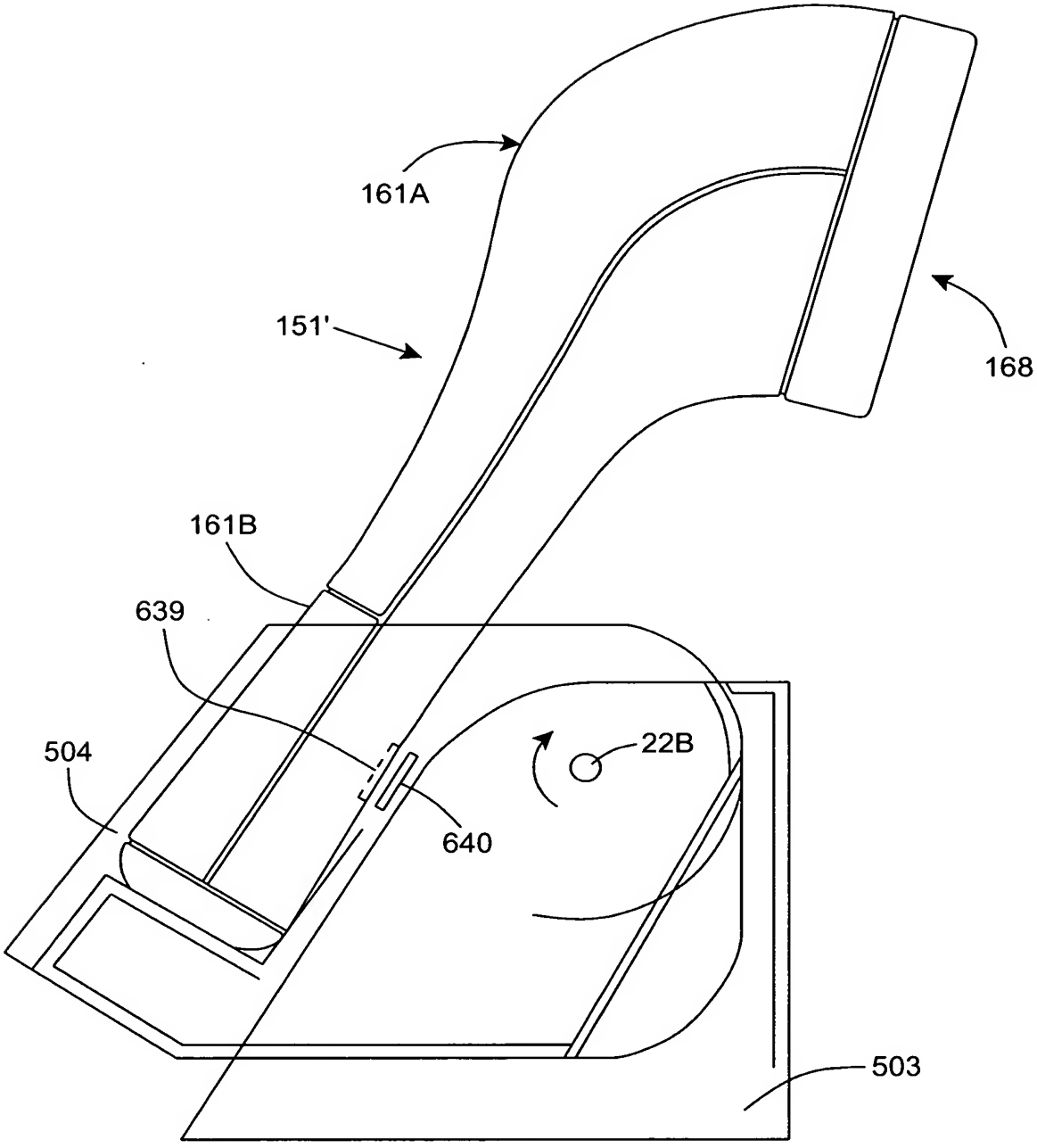

FIG. 5B

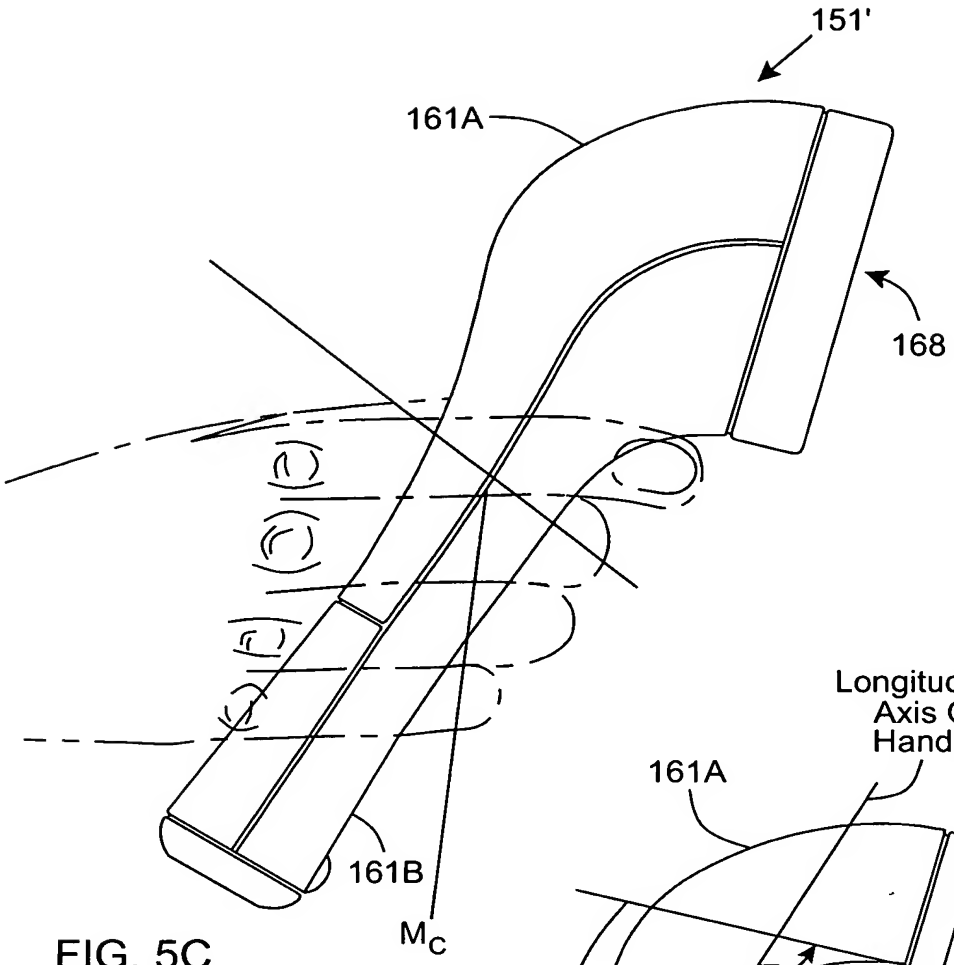
151'
161A
168
161B
M_C

FIG. 5C

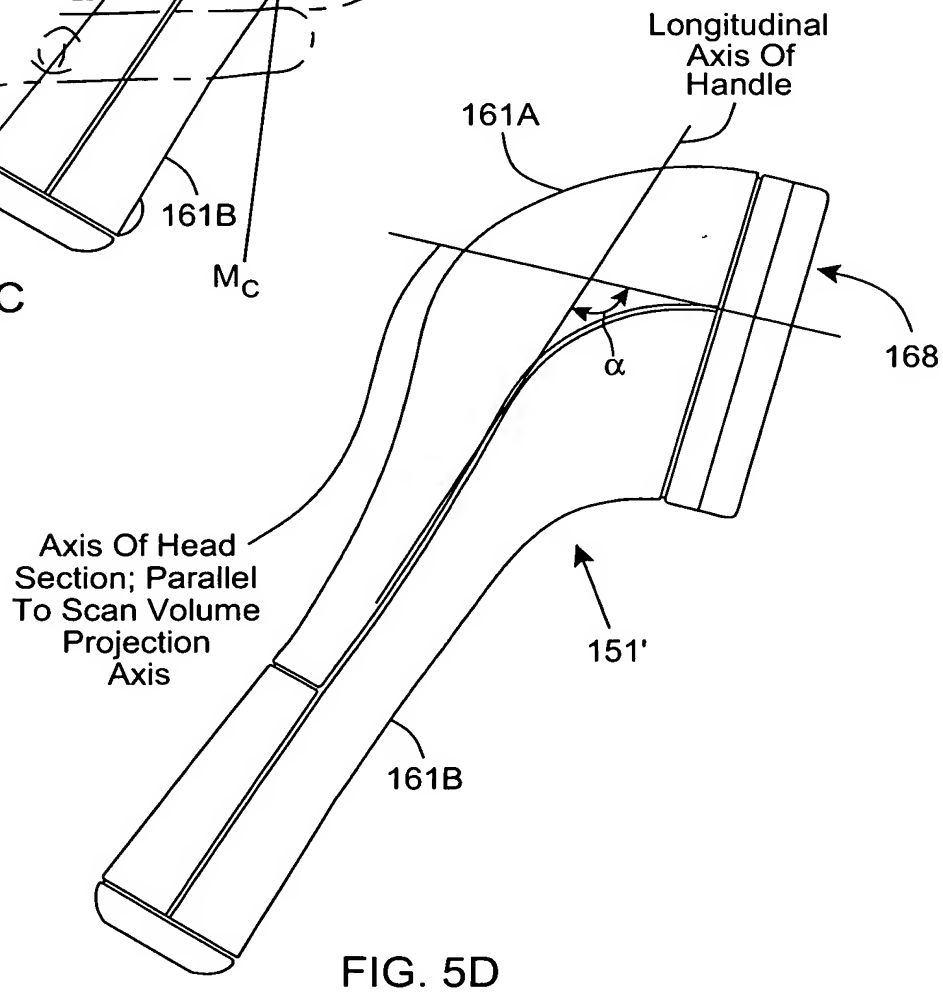
Longitudinal Axis Of Handle
161A
168
α
Axis Of Head Section; Parallel To Scan Volume Projection Axis
151'
161B

FIG. 5D

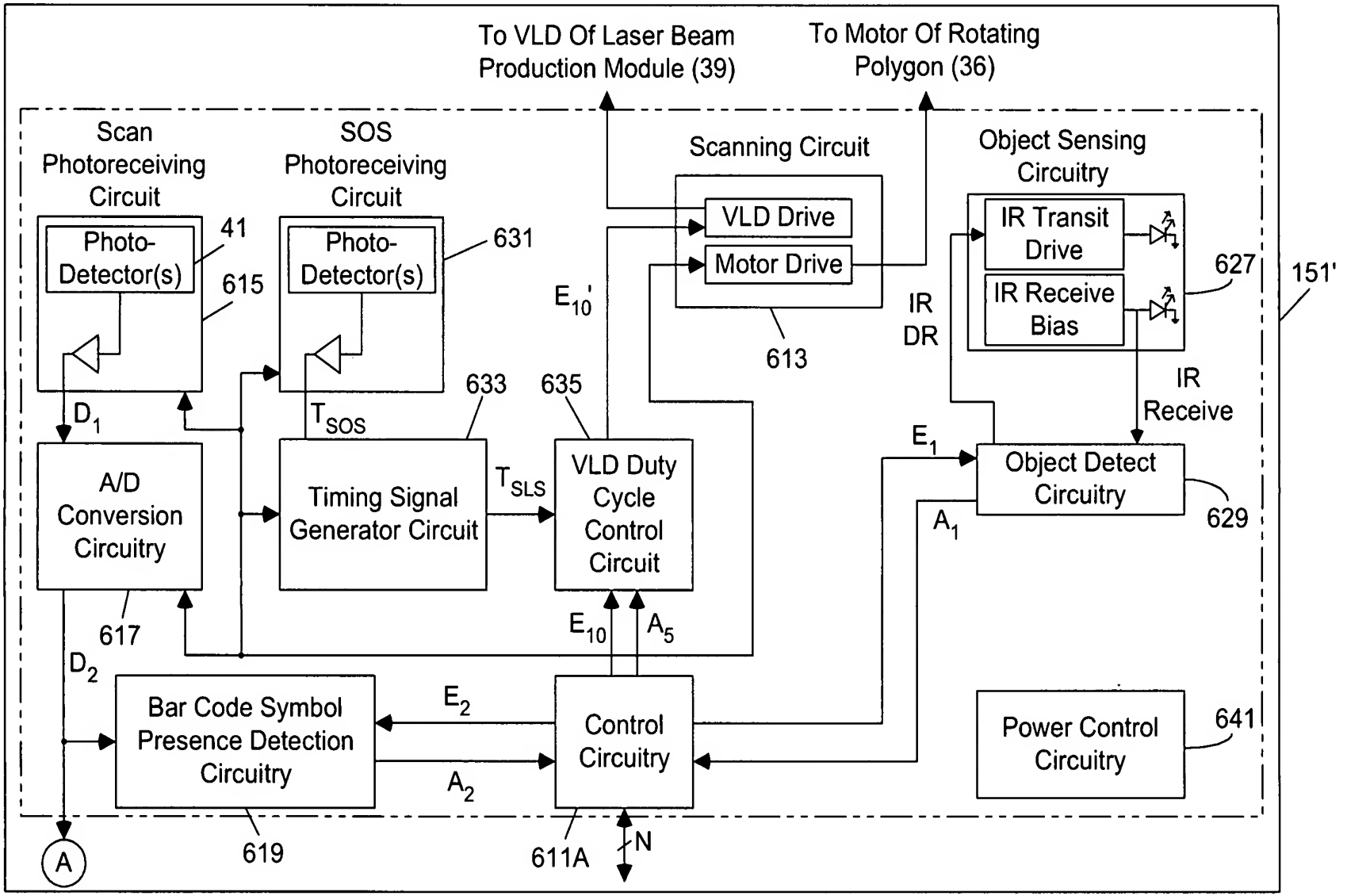
To VLD Of Laser Beam Production Module (39)
To Motor Of Rotating Polygon (36)
Scan Photoreceiving Circuit
Photo-Detector(s)
41
615
SOS Photoreceiving Circuit
Photo-Detector(s)
631
Scanning Circuit
VLD Drive
Motor Drive
613
Object Sensing Circuitry
IR Transit Drive
IR Receive Bias
627
151'
IR DR
IR Receive
E_{10}'
D_1
T_{SOS}
633
635
A/D Conversion Circuitry
Timing Signal Generator Circuit
T_{SLS}
VLD Duty Cycle Control Circuit
E_1
Object Detect Circuitry
629
A_1
617
E_{10}
A_5
D_2
Bar Code Symbol Presence Detection Circuitry
E_2
A_2
Control Circuitry
Power Control Circuitry
641
A
619
611A
N

FIG. 6A

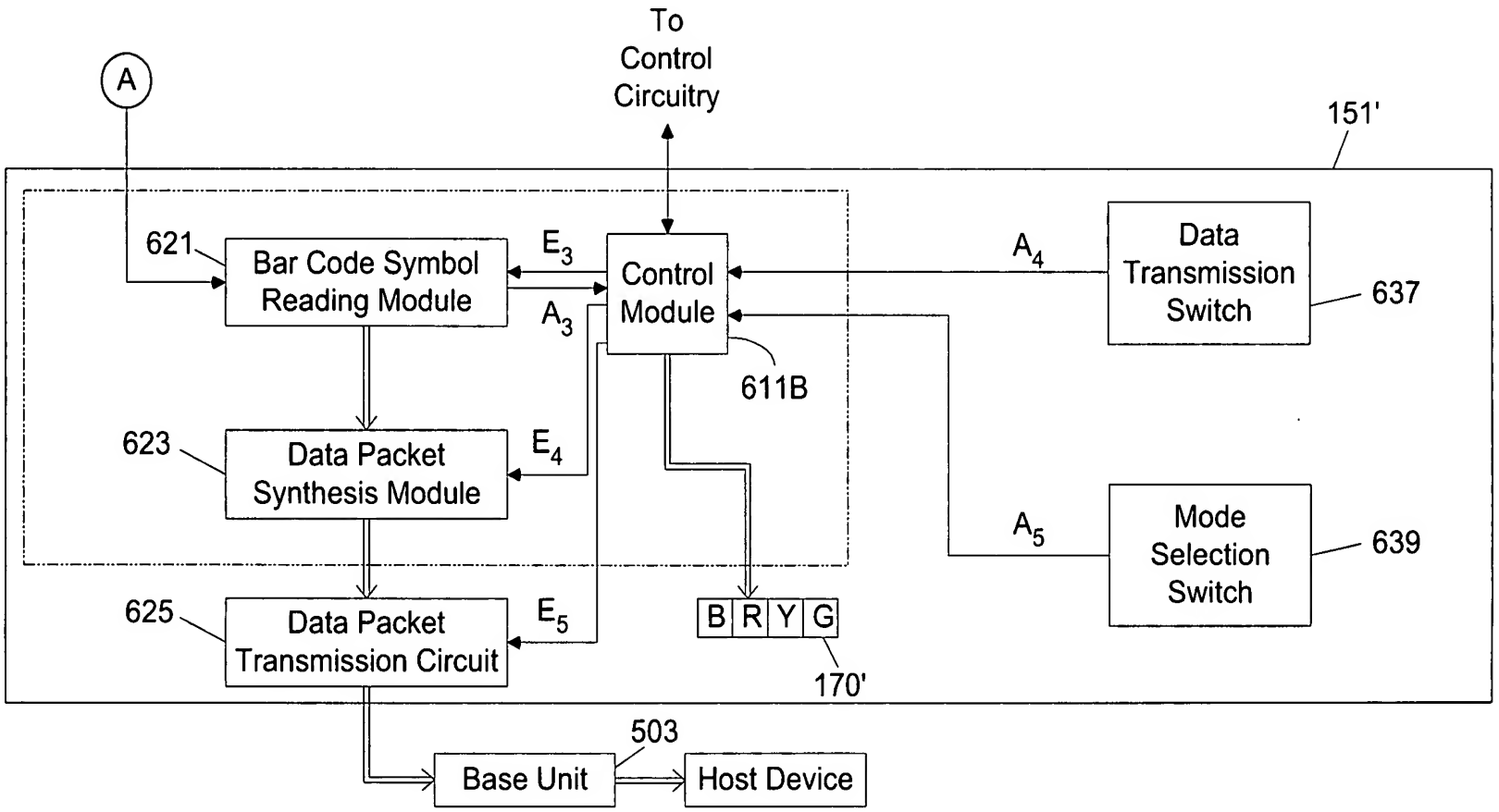
To
Control
Circuitry
A
151'
621
Bar Code Symbol
Reading Module
E_3
A_3
Control
Module
611B
A_4
Data
Transmission
Switch
637
623
Data Packet
Synthesis Module
E_4
A_5
Mode
Selection
Switch
639
625
Data Packet
Transmission Circuit
E_5
B R Y G
170'
503
Base Unit
Host Device

FIG. 6B

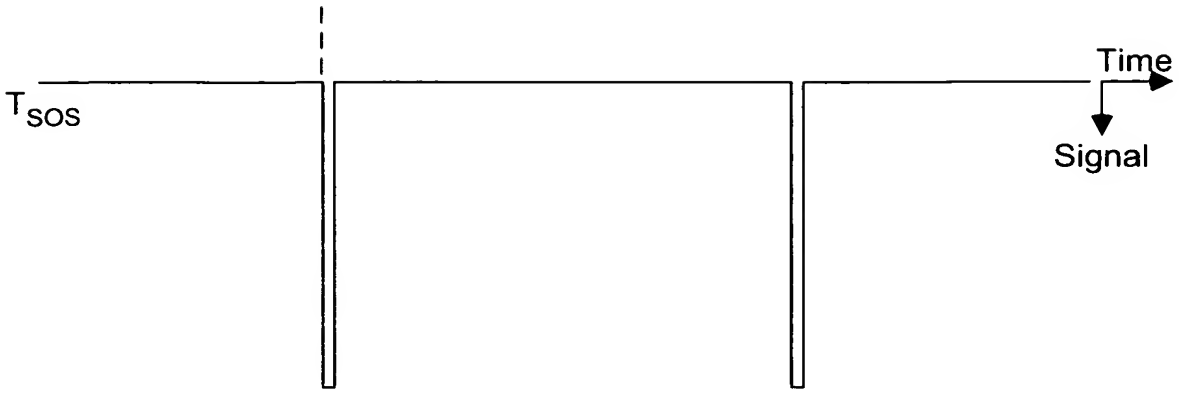

FIG. 7A

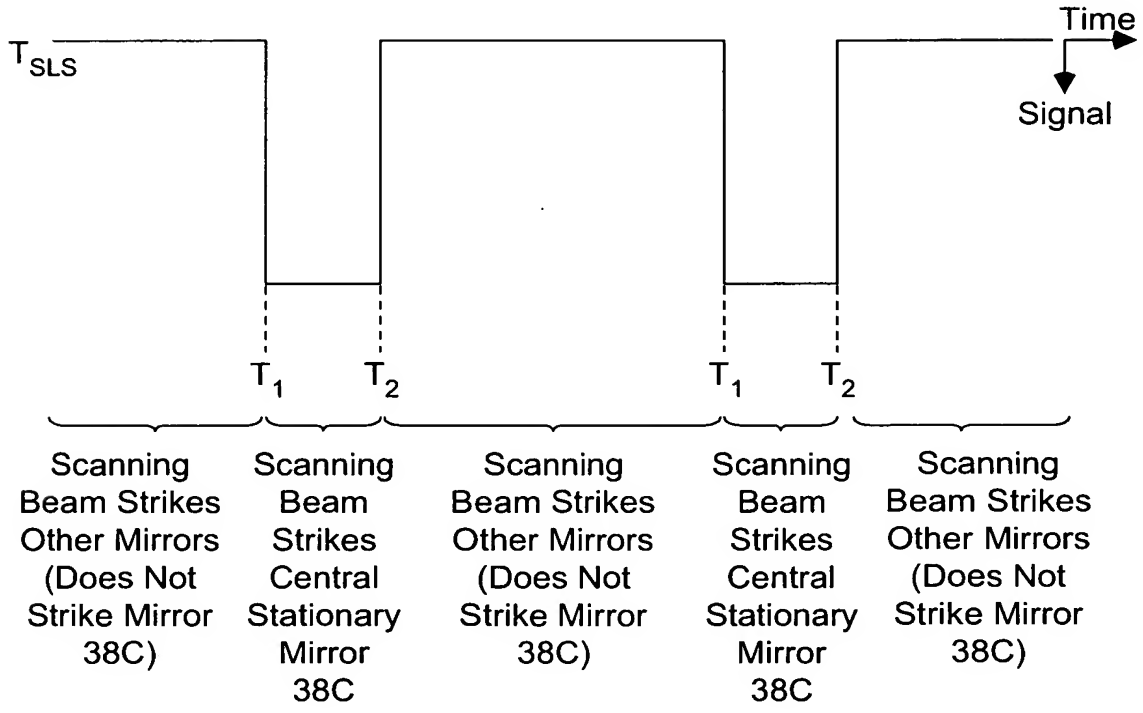

FIG. 7B

$$E_{10}' = (\overline{T_{SLS}} \times E_{10} \times A_5) + (E_{10} \times \overline{A_5})$$

FIG. 7C

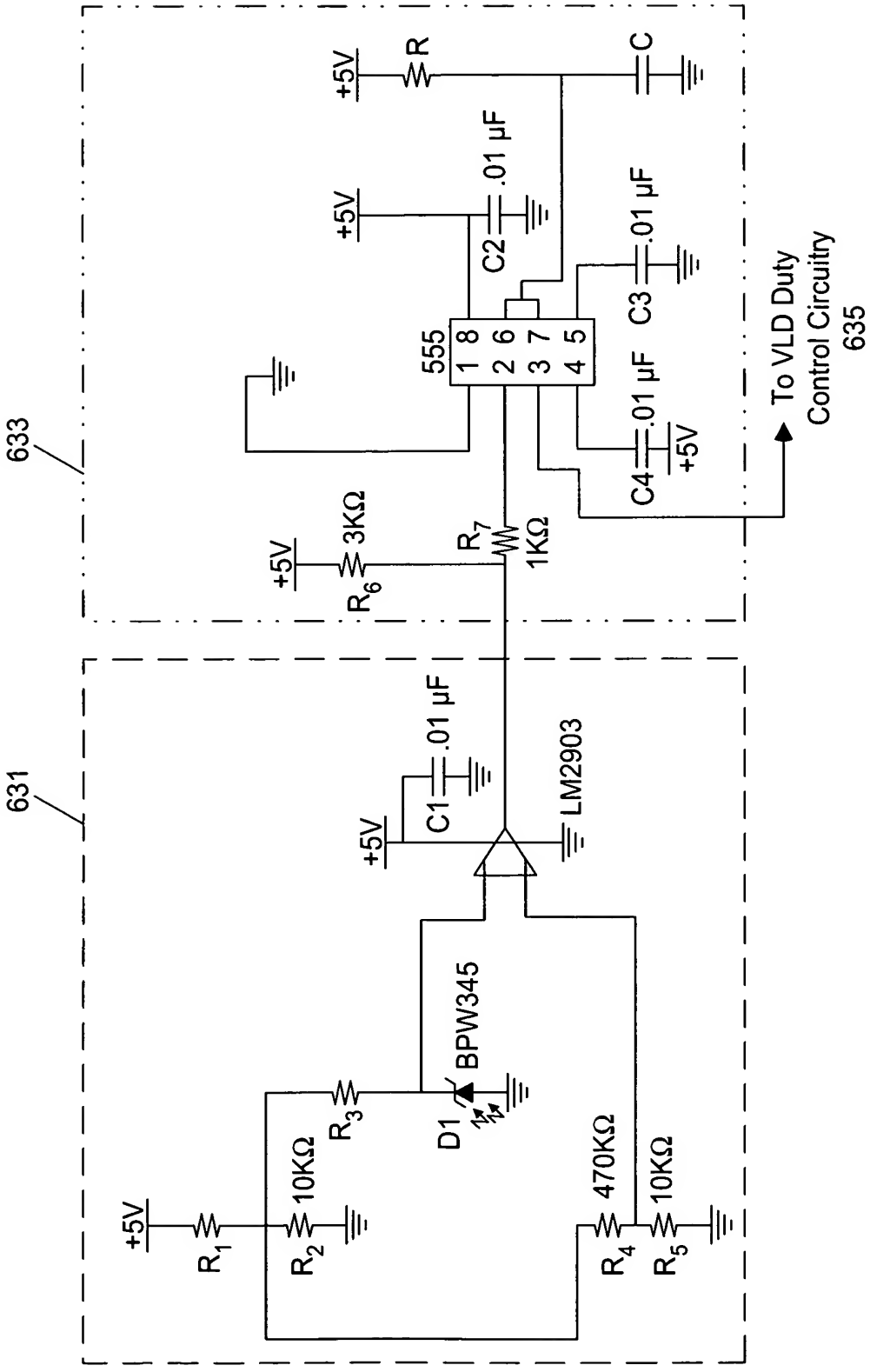
633
631
+5V
R
C
.01 µF
C2
C3
555
1 8
2 6
3 7
4 5
C4
To VLD Duty
Control Circuitry
635
3KΩ
R6
R7
1KΩ
C1
LM2903
BPW345
D1
R3
10KΩ
R2
R1
470KΩ
R4
10KΩ
R5

FIG. 7D

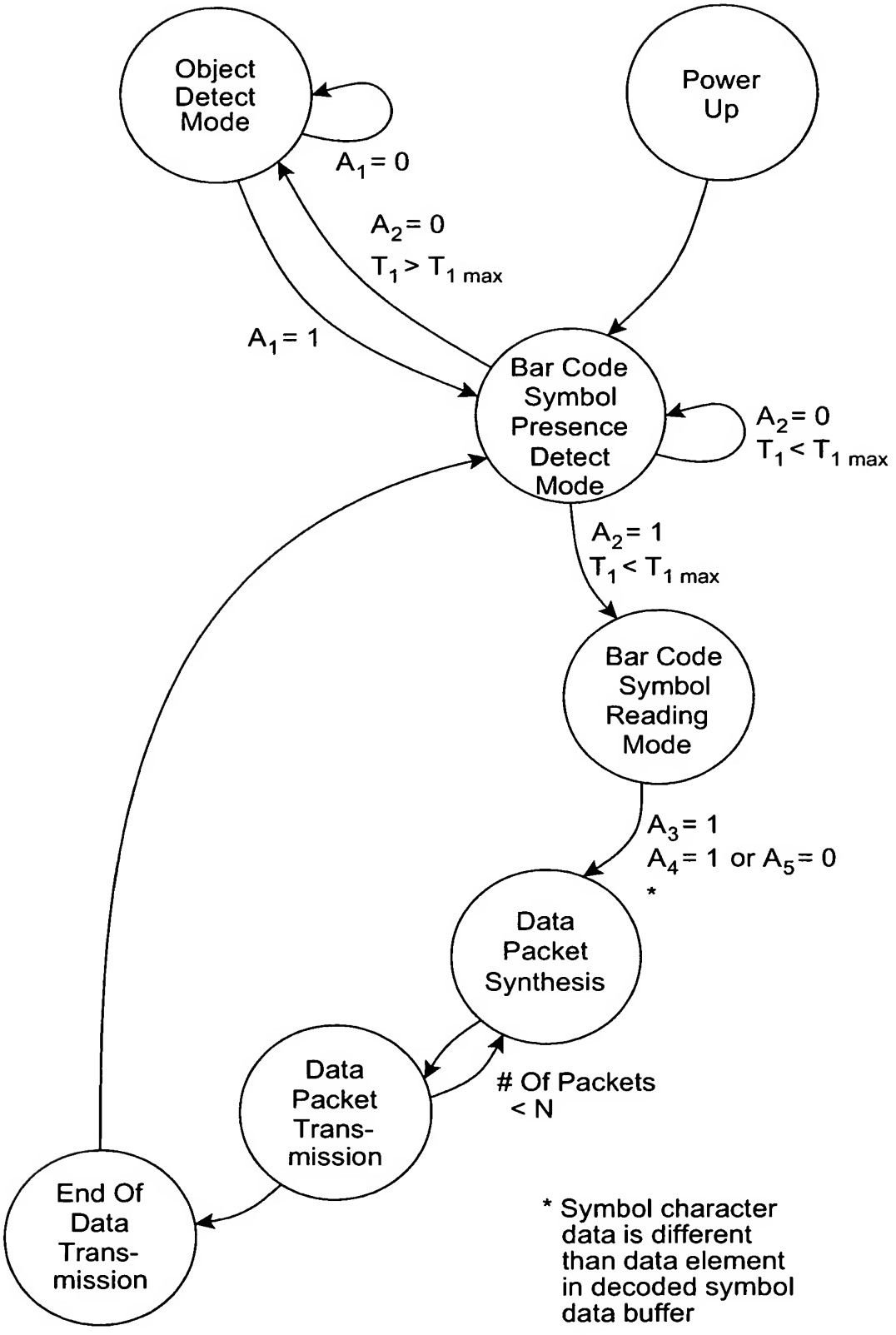
Object Detect Mode
Power Up
$A_1 = 0$
$A_2 = 0$
$T_1 > T_{1\ max}$
$A_1 = 1$
Bar Code Symbol Presence Detect Mode
$A_2 = 0$
$T_1 < T_{1\ max}$
$A_2 = 1$
$T_1 < T_{1\ max}$
Bar Code Symbol Reading Mode
$A_3 = 1$
$A_4 = 1$ or $A_5 = 0$
*
Data Packet Synthesis
Data Packet Trans-mission
Of Packets < N
End Of Data Trans-mission
* Symbol character data is different than data element in decoded symbol data buffer

FIG. 8

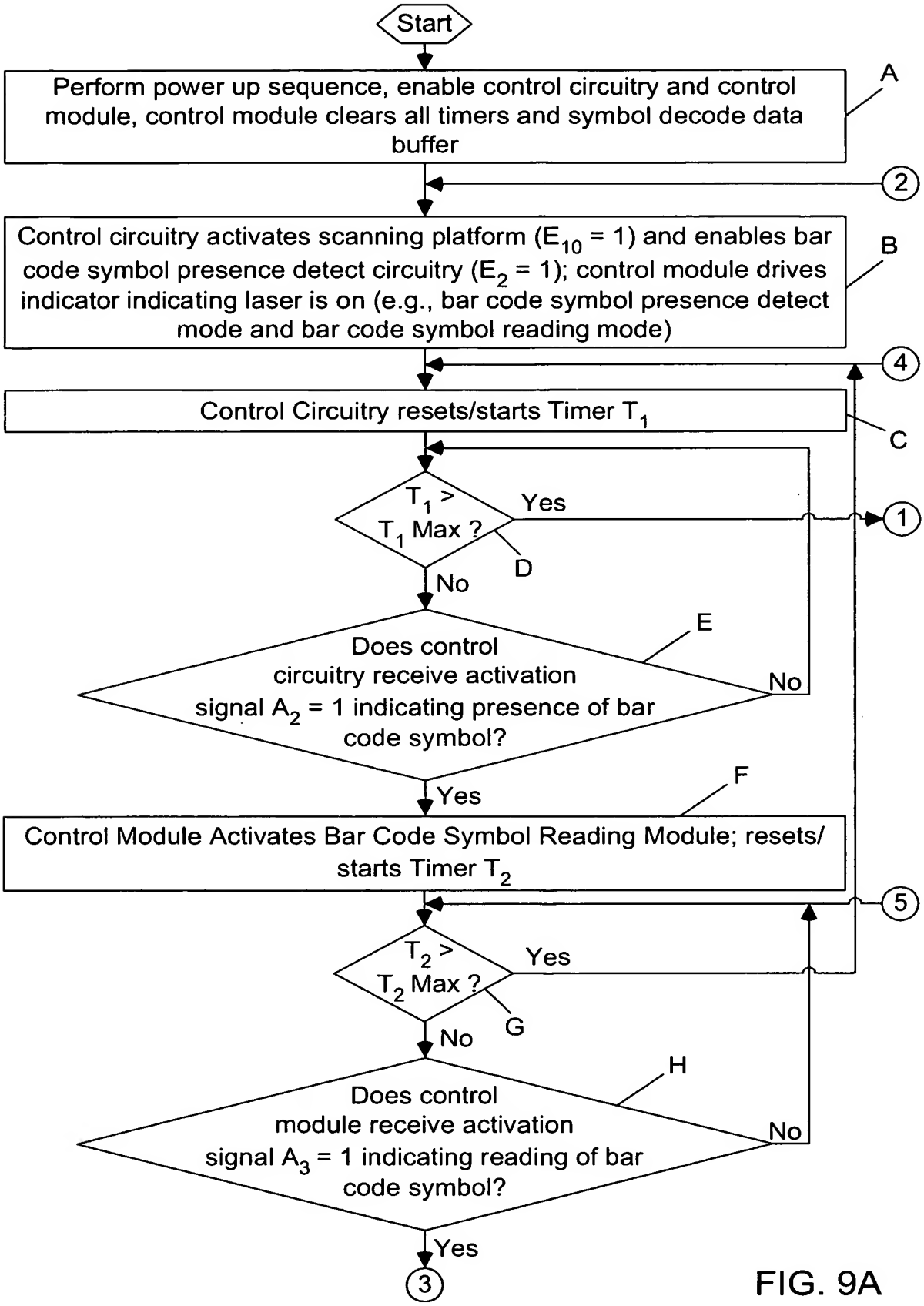
Start
Perform power up sequence, enable control circuitry and control module, control module clears all timers and symbol decode data buffer
A
2
Control circuitry activates scanning platform (E_{10} = 1) and enables bar code symbol presence detect circuitry (E_2 = 1); control module drives indicator indicating laser is on (e.g., bar code symbol presence detect mode and bar code symbol reading mode)
B
4
Control Circuitry resets/starts Timer T_1
C
T_1 > T_1 Max ?
Yes
1
D
No
Does control circuitry receive activation signal A_2 = 1 indicating presence of bar code symbol?
E
No
Yes
F
Control Module Activates Bar Code Symbol Reading Module; resets/ starts Timer T_2
5
T_2 > T_2 Max ?
Yes
G
No
Does control module receive activation signal A_3 = 1 indicating reading of bar code symbol?
H
No
Yes
3

FIG. 9A

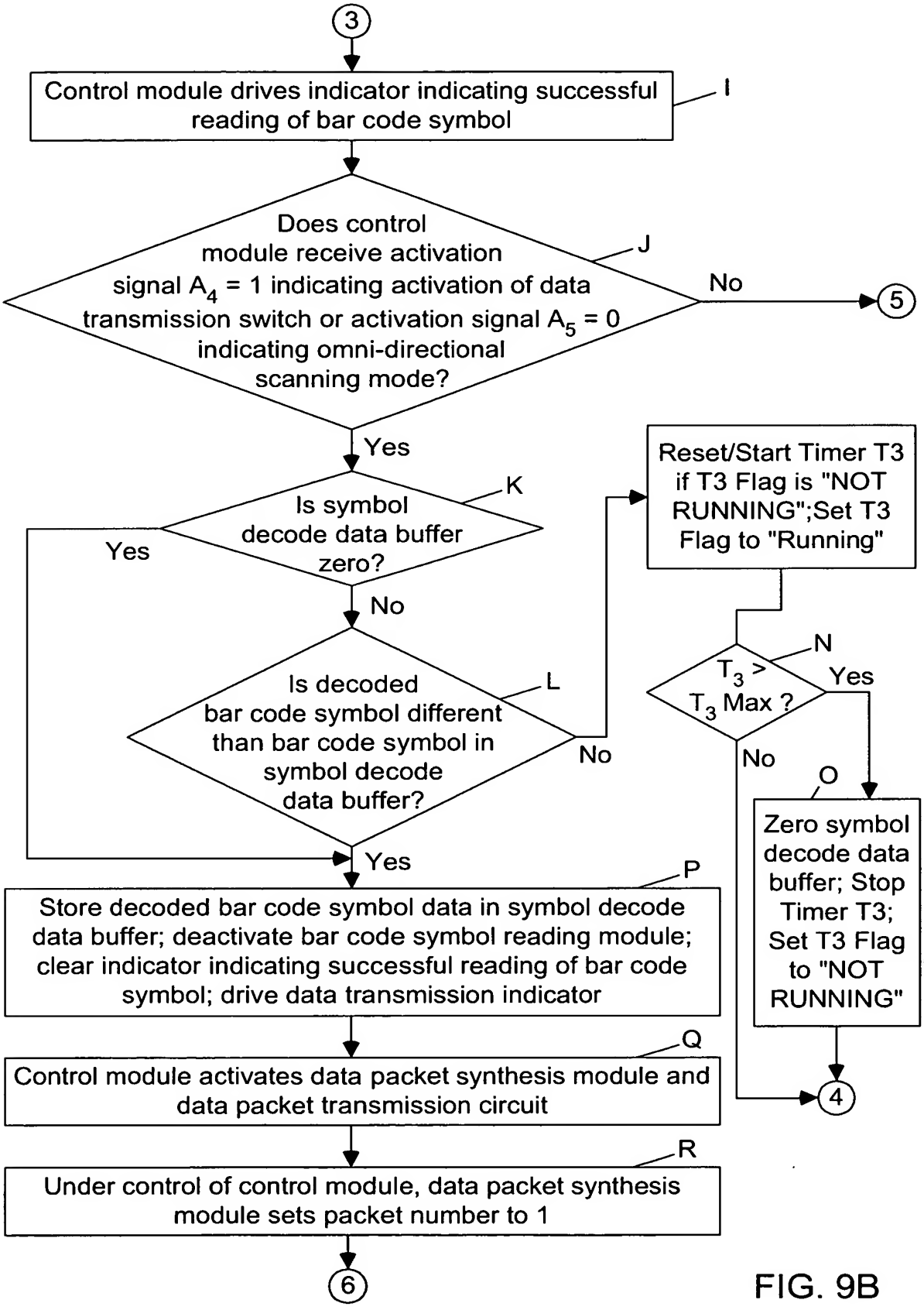
3
Control module drives indicator indicating successful reading of bar code symbol
I
Does control module receive activation signal A_4 = 1 indicating activation of data transmission switch or activation signal A_5 = 0 indicating omni-directional scanning mode?
J
No
5
Yes
Is symbol decode data buffer zero?
K
Yes
No
Is decoded bar code symbol different than bar code symbol in symbol decode data buffer?
L
No
Yes
Reset/Start Timer T3 if T3 Flag is "NOT RUNNING";Set T3 Flag to "Running"
T_3 > T_3 Max ?
N
Yes
No
Zero symbol decode data buffer; Stop Timer T3; Set T3 Flag to "NOT RUNNING"
O
4
Store decoded bar code symbol data in symbol decode data buffer; deactivate bar code symbol reading module; clear indicator indicating successful reading of bar code symbol; drive data transmission indicator
P
Control module activates data packet synthesis module and data packet transmission circuit
Q
Under control of control module, data packet synthesis module sets packet number to 1
R
6

FIG. 9B

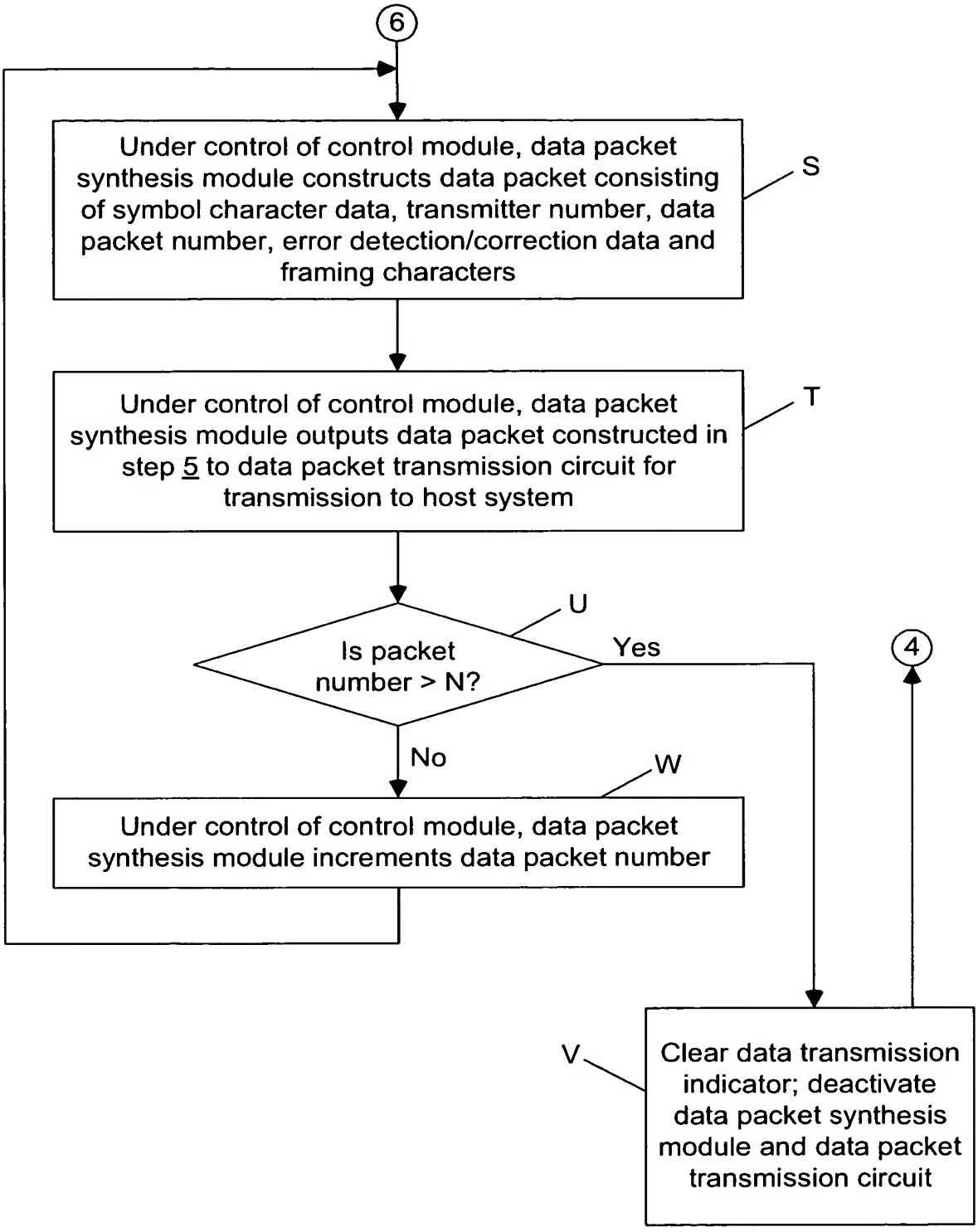
6
Under control of control module, data packet synthesis module constructs data packet consisting of symbol character data, transmitter number, data packet number, error detection/correction data and framing characters
S
Under control of control module, data packet synthesis module outputs data packet constructed in step 5 to data packet transmission circuit for transmission to host system
T
U
Is packet number > N?
Yes
No
W
Under control of control module, data packet synthesis module increments data packet number
4
V
Clear data transmission indicator; deactivate data packet synthesis module and data packet transmission circuit

FIG. 9C

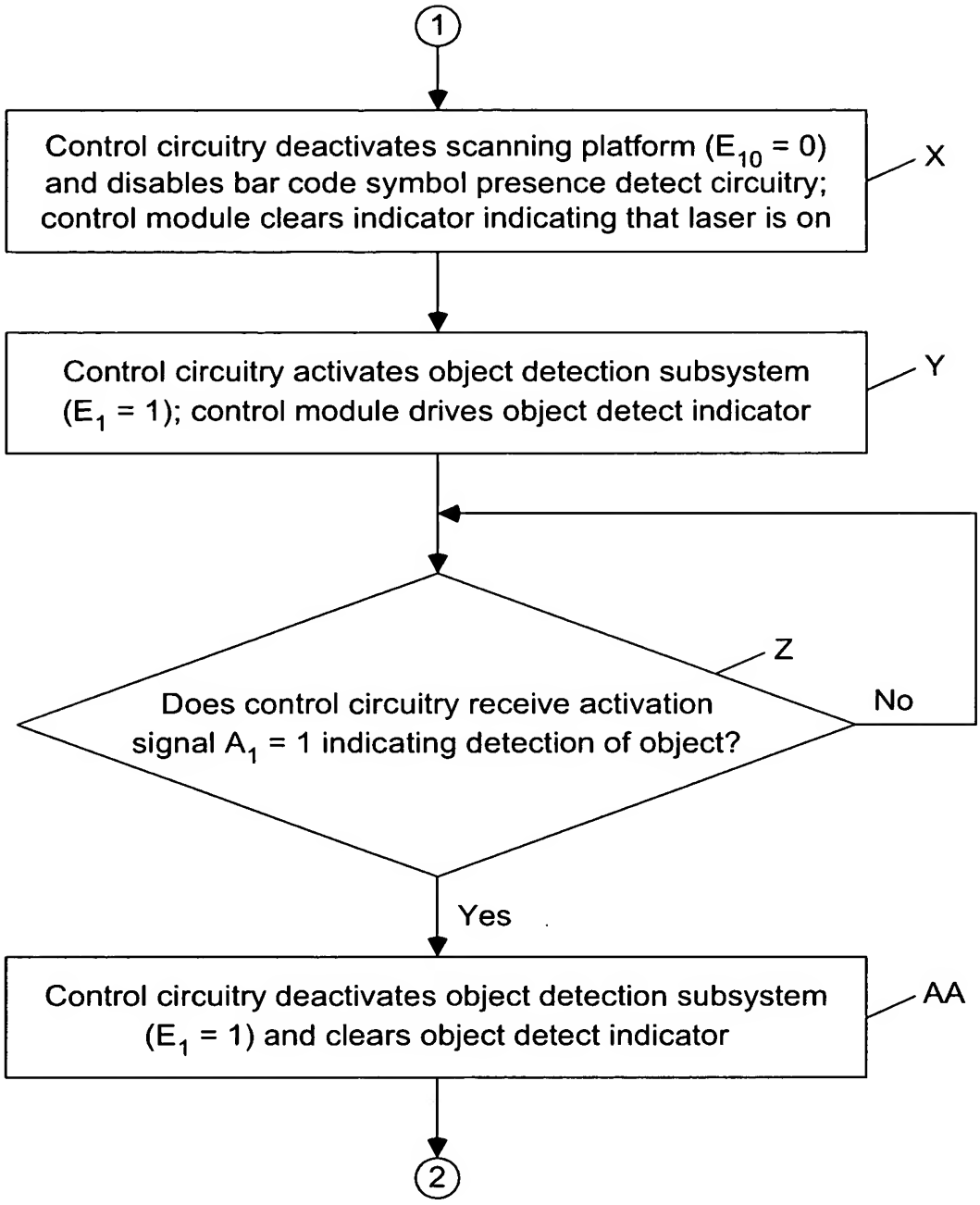
1
Control circuitry deactivates scanning platform (E_{10} = 0) and disables bar code symbol presence detect circuitry; control module clears indicator indicating that laser is on
X
Control circuitry activates object detection subsystem (E_1 = 1); control module drives object detect indicator
Y
Z
Does control circuitry receive activation signal A_1 = 1 indicating detection of object?
No
Yes
Control circuitry deactivates object detection subsystem (E_1 = 1) and clears object detect indicator
AA
2

FIG. 9D

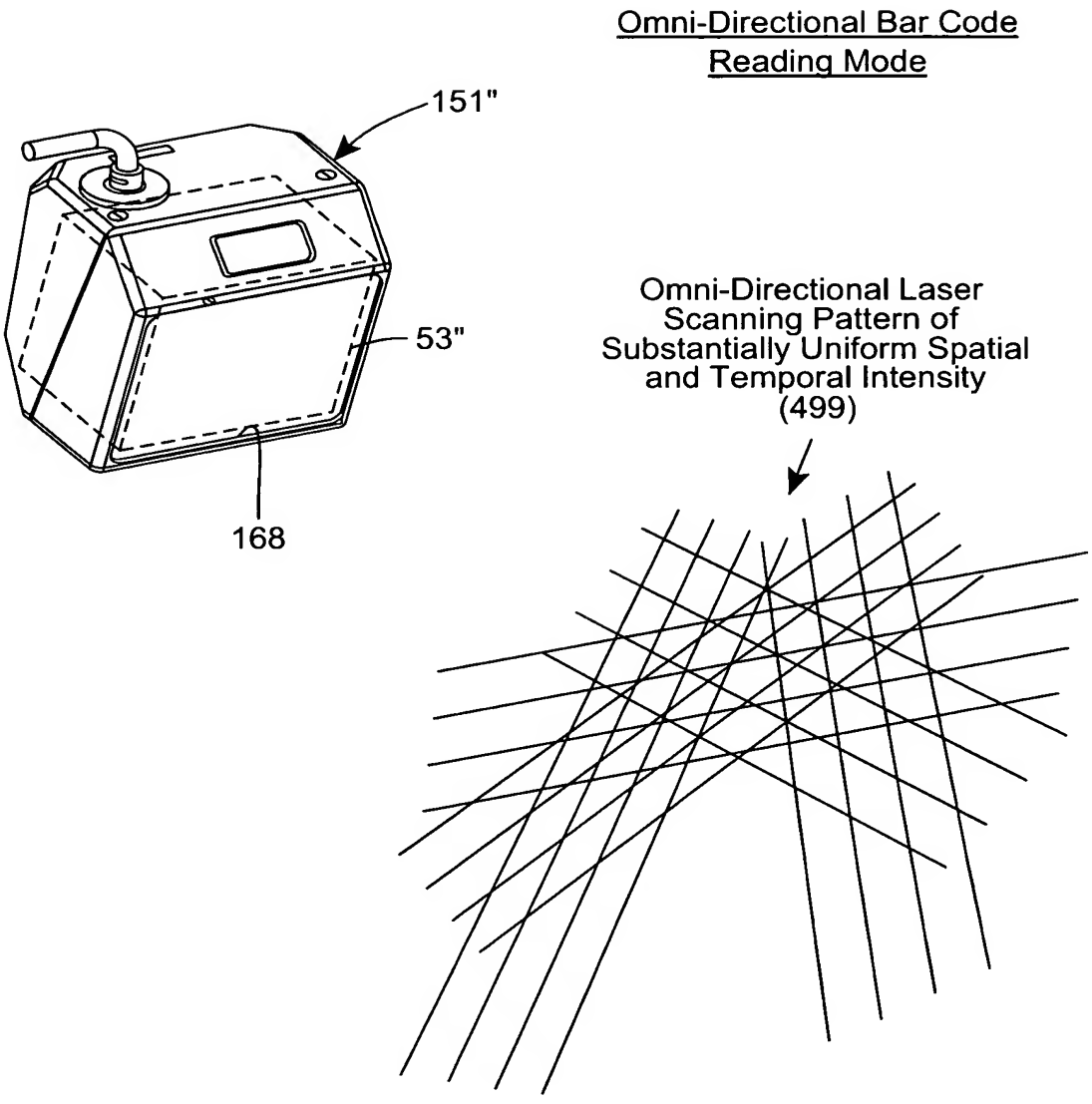
Omni-Directional Bar Code Reading Mode
151"
53"
168
Omni-Directional Laser Scanning Pattern of Substantially Uniform Spatial and Temporal Intensity (499)

FIG. 10A

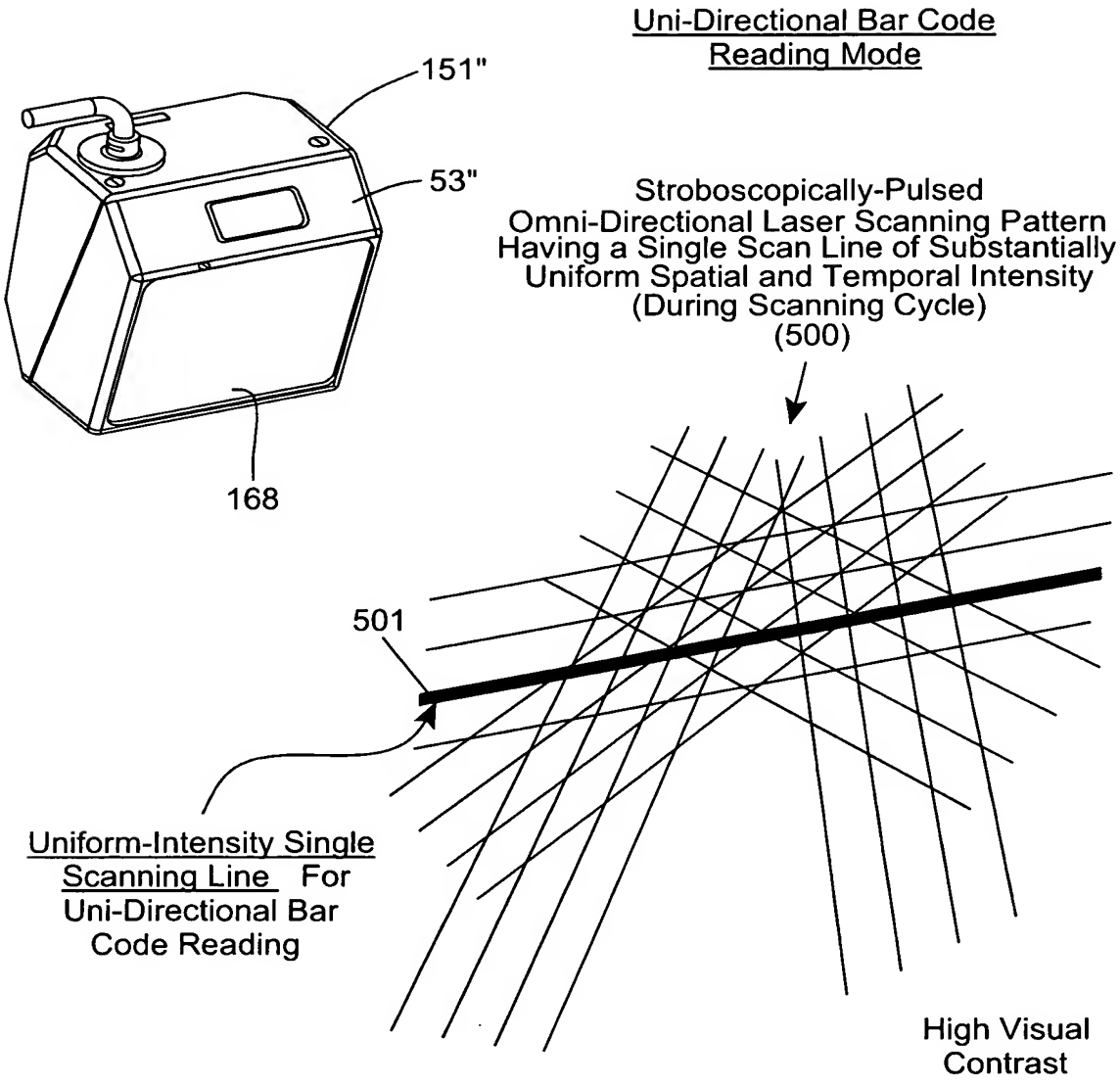
Uni-Directional Bar Code Reading Mode
151"
53"
168
Stroboscopically-Pulsed Omni-Directional Laser Scanning Pattern Having a Single Scan Line of Substantially Uniform Spatial and Temporal Intensity (During Scanning Cycle) (500)
501
Uniform-Intensity Single Scanning Line For Uni-Directional Bar Code Reading
High Visual Contrast

FIG. 10B

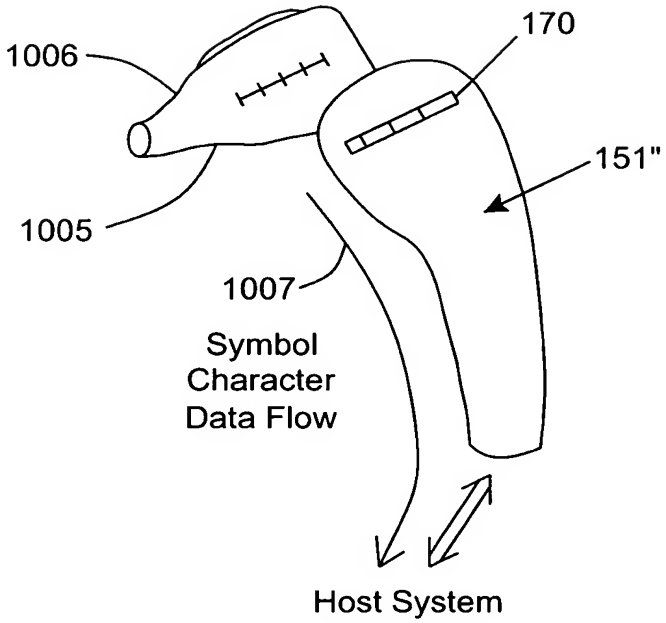
1006
170
151"
1005
1007
Symbol
Character
Data Flow
Host System

FIG. 11A

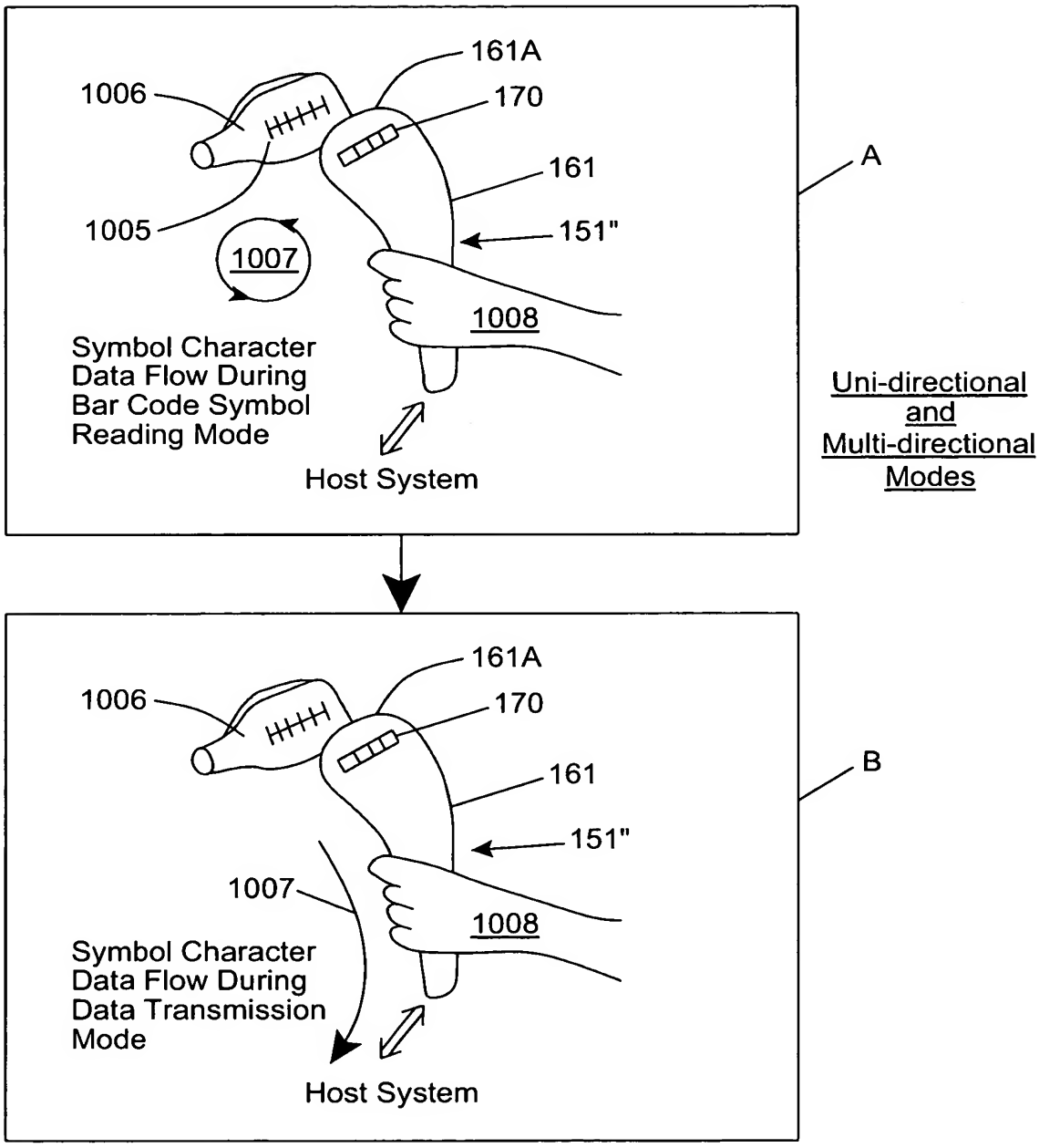
161A
1006
170
161
A
1005
151"
1007
1008
Symbol Character
Data Flow During
Bar Code Symbol
Reading Mode
Host System
Uni-directional
and
Multi-directional
Modes
161A
1006
170
161
B
151"
1007
1008
Symbol Character
Data Flow During
Data Transmission
Mode
Host System

FIG. 11B

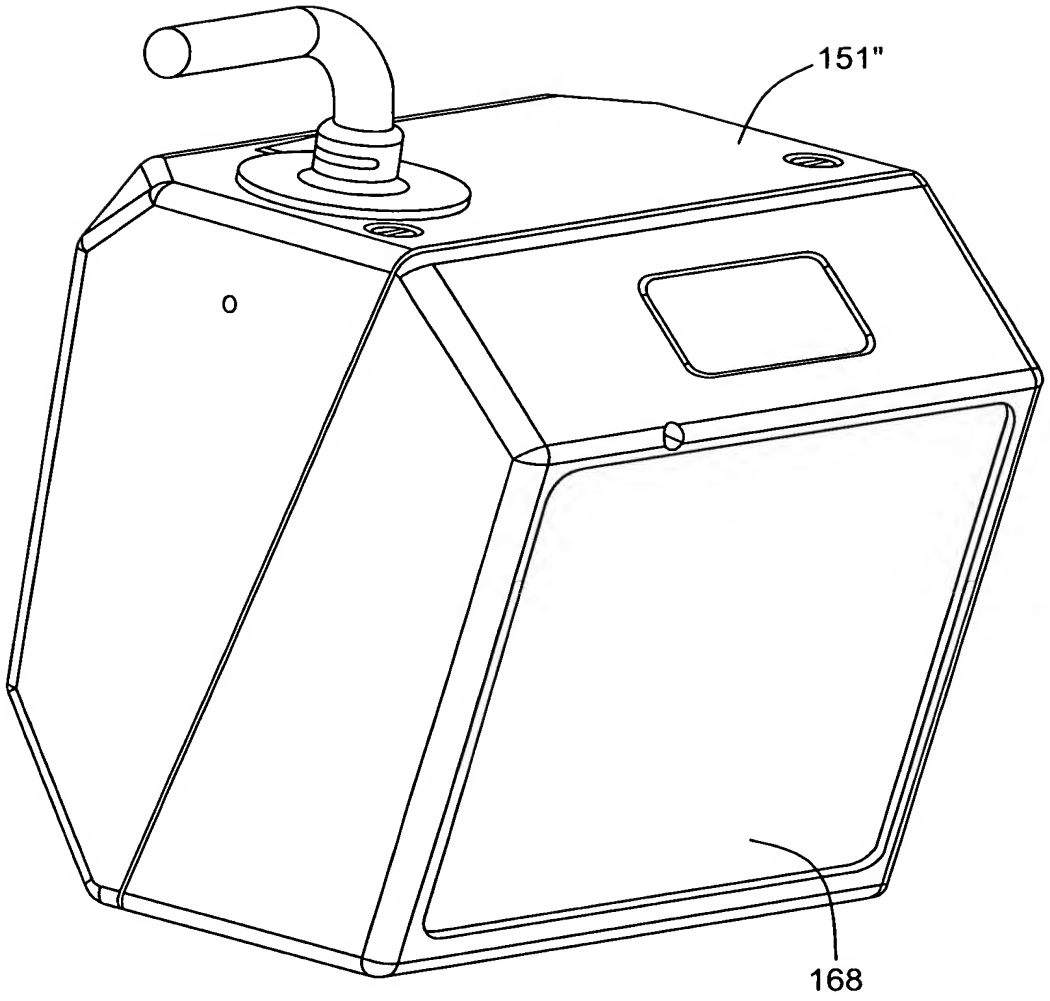

FIG. 12A

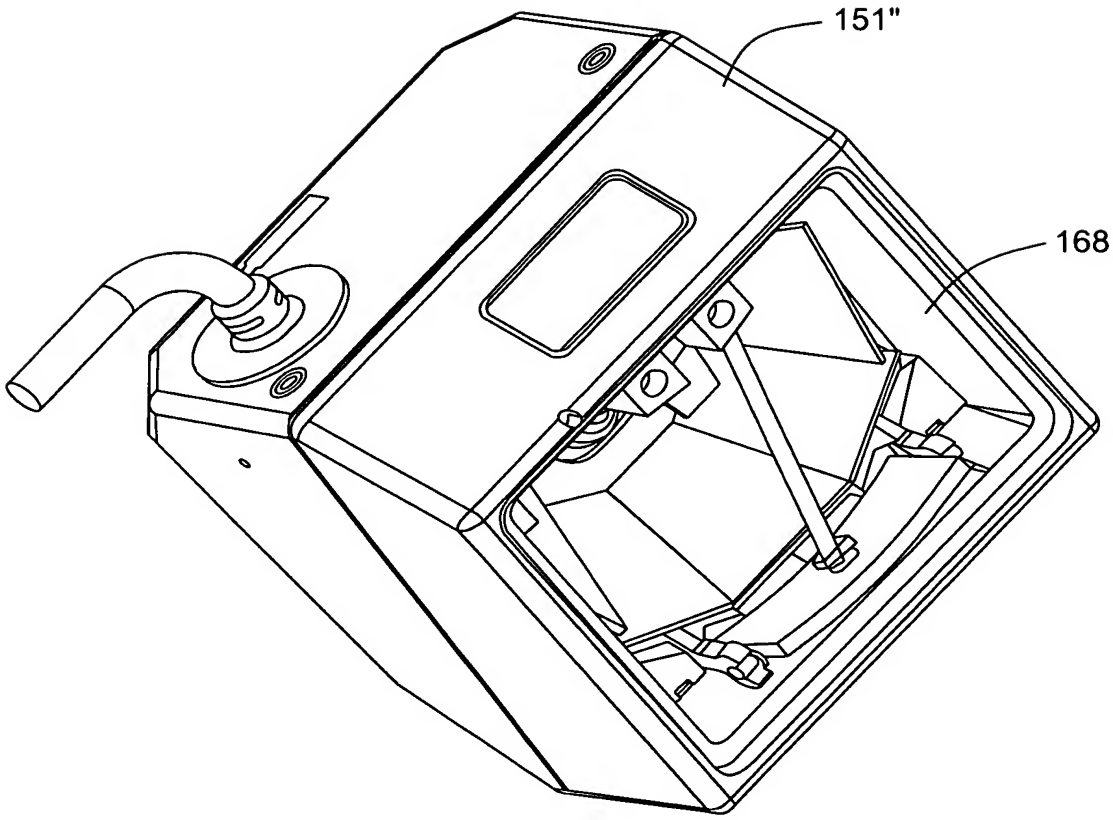

FIG. 12B

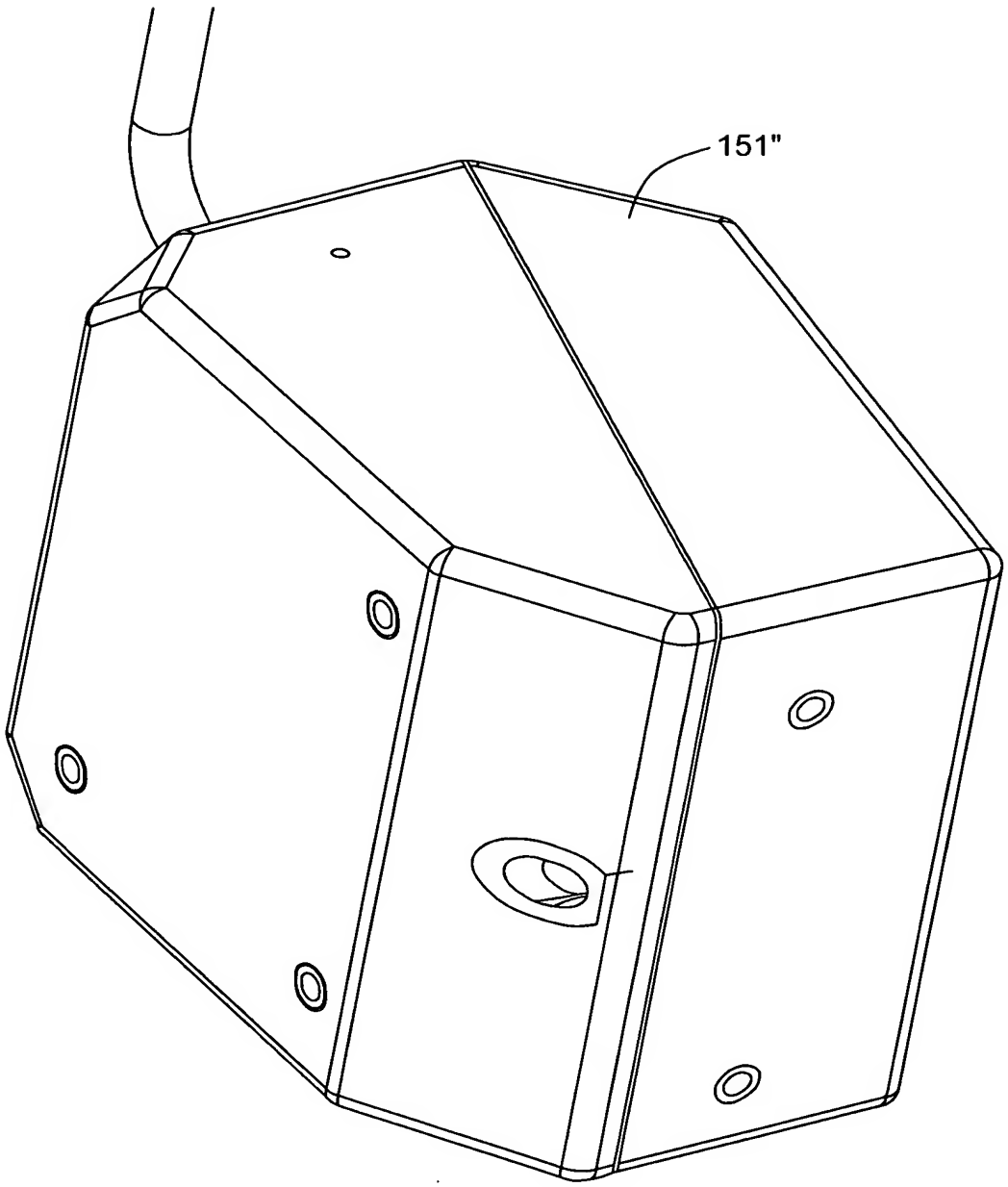

FIG. 12C

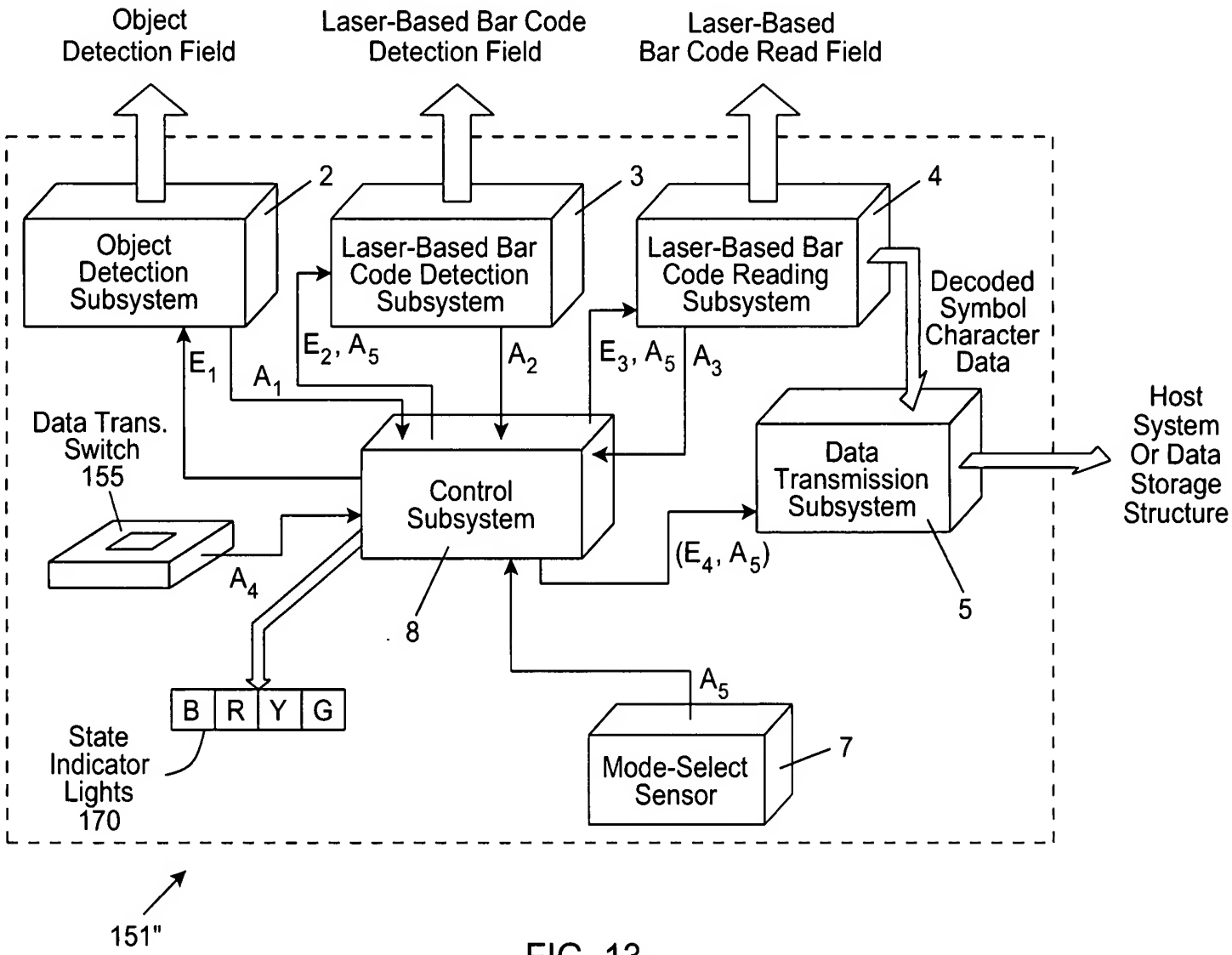
Object Detection Field
Laser-Based Bar Code Detection Field
Laser-Based Bar Code Read Field
Object Detection Subsystem
2
Laser-Based Bar Code Detection Subsystem
3
Laser-Based Bar Code Reading Subsystem
4
Decoded Symbol Character Data
E_1
A_1
E_2, A_5
A_2
E_3, A_5
A_3
Data Trans. Switch 155
Control Subsystem
Data Transmission Subsystem
Host System Or Data Storage Structure
A_4
(E_4, A_5)
5
8
A_5
B R Y G
State Indicator Lights 170
Mode-Select Sensor
7
151"

FIG. 13

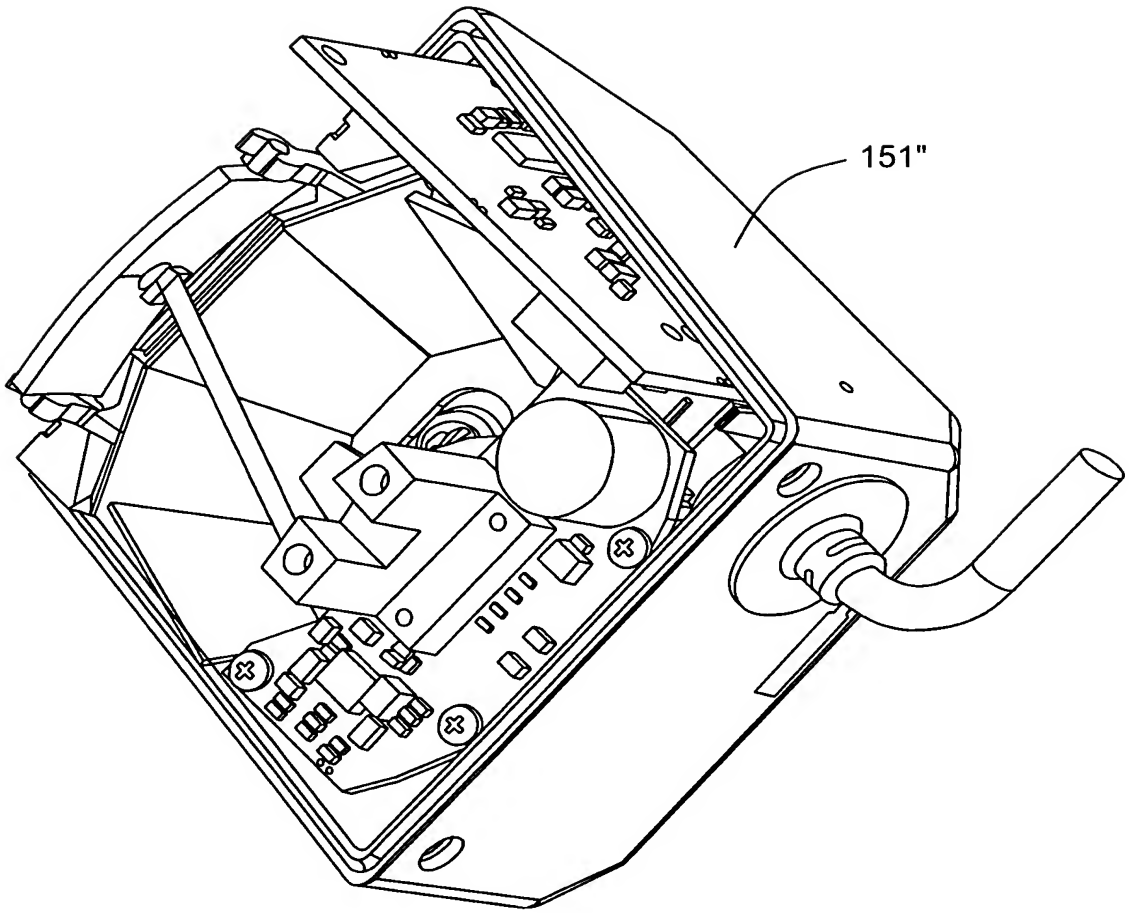

FIG. 14A

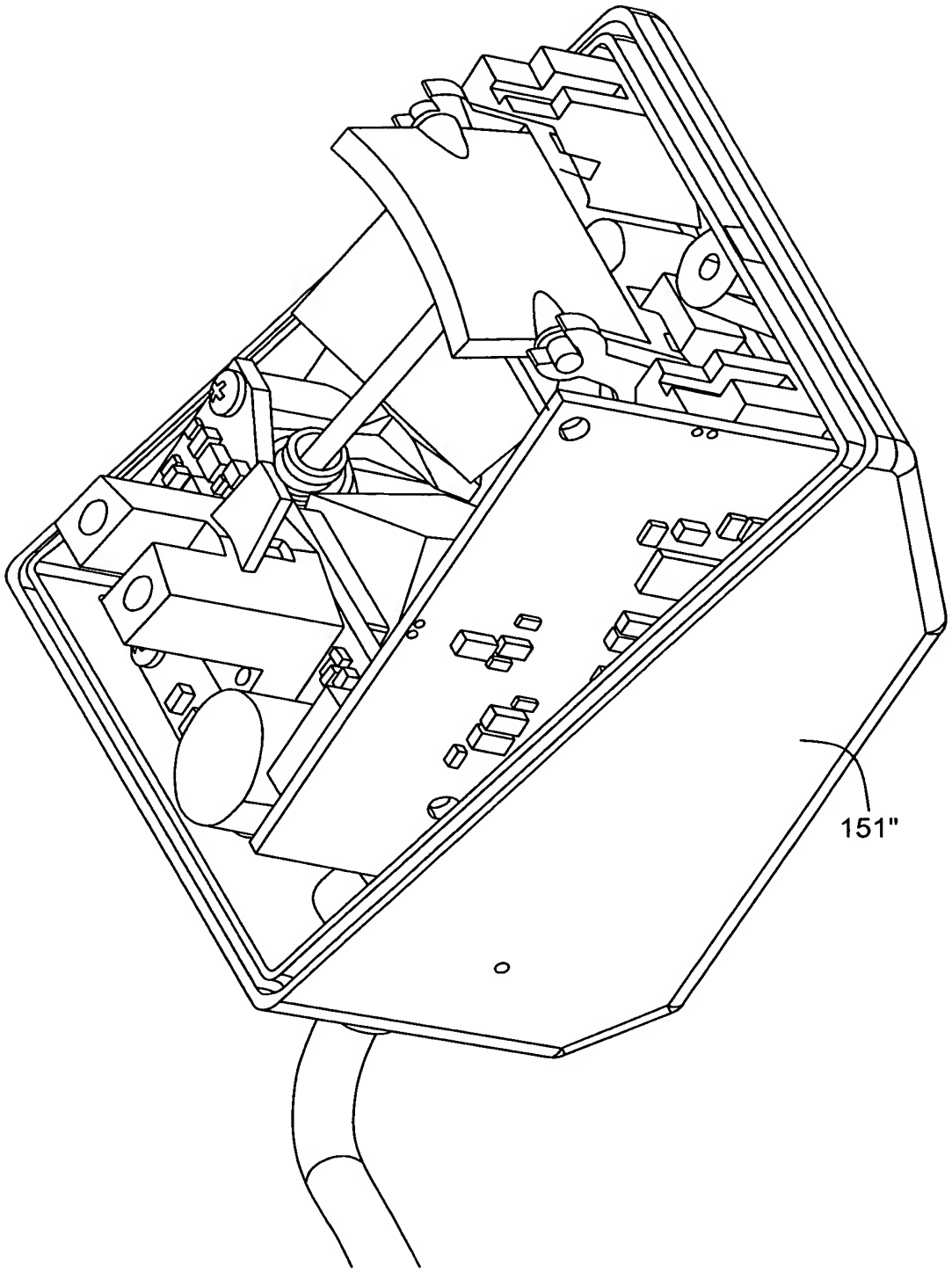

FIG. 14B

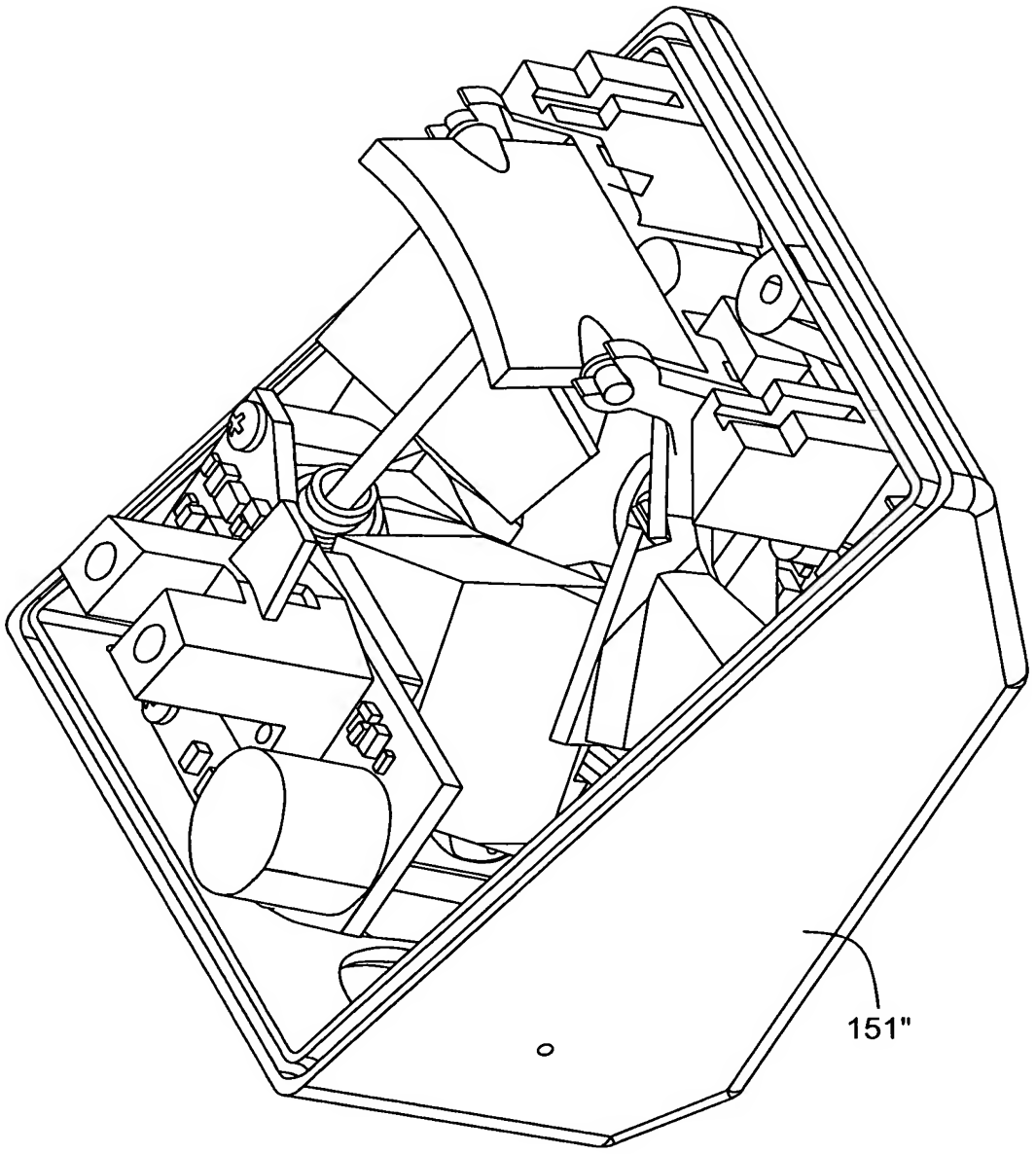

FIG. 14C

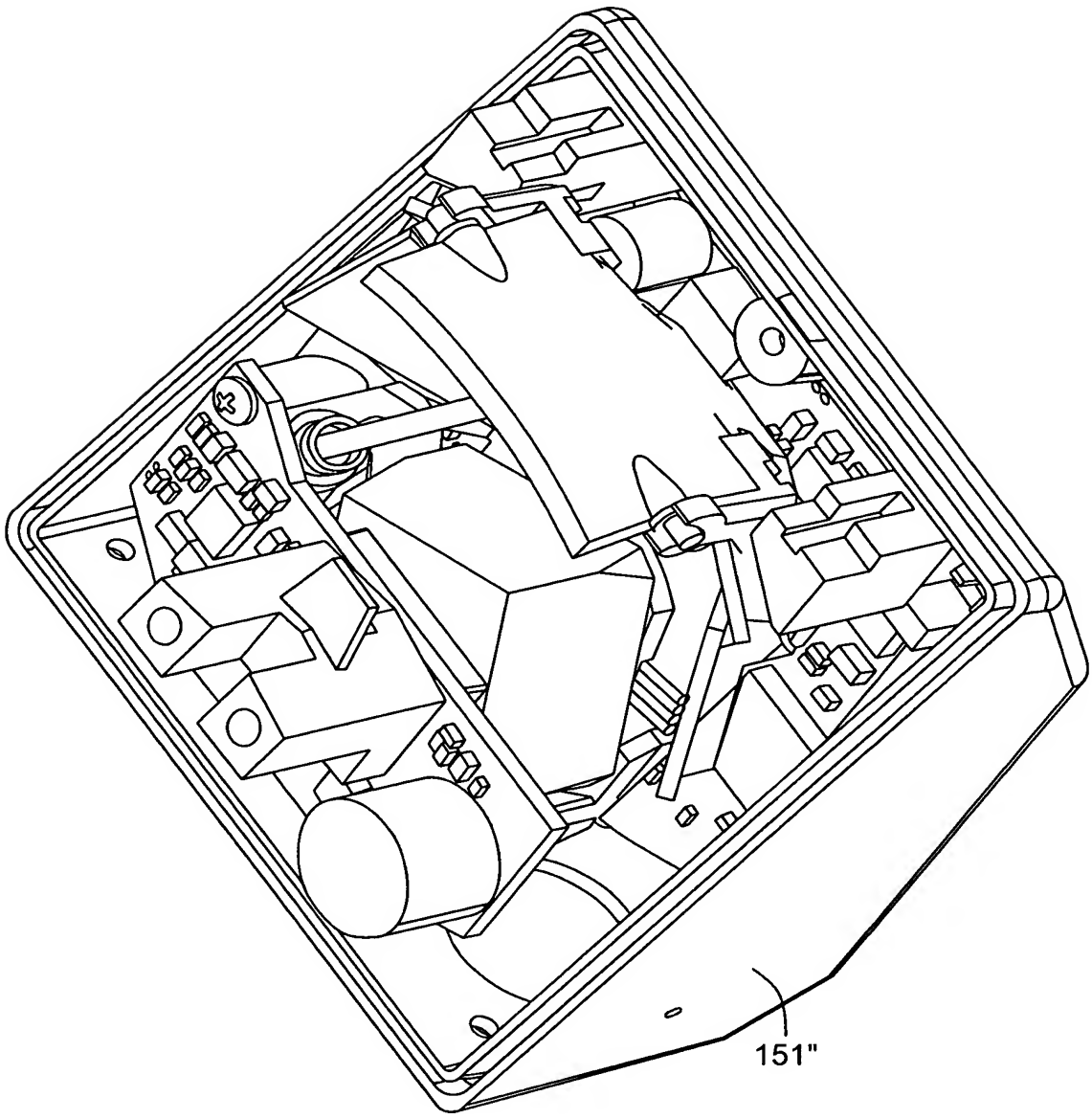

FIG. 14D

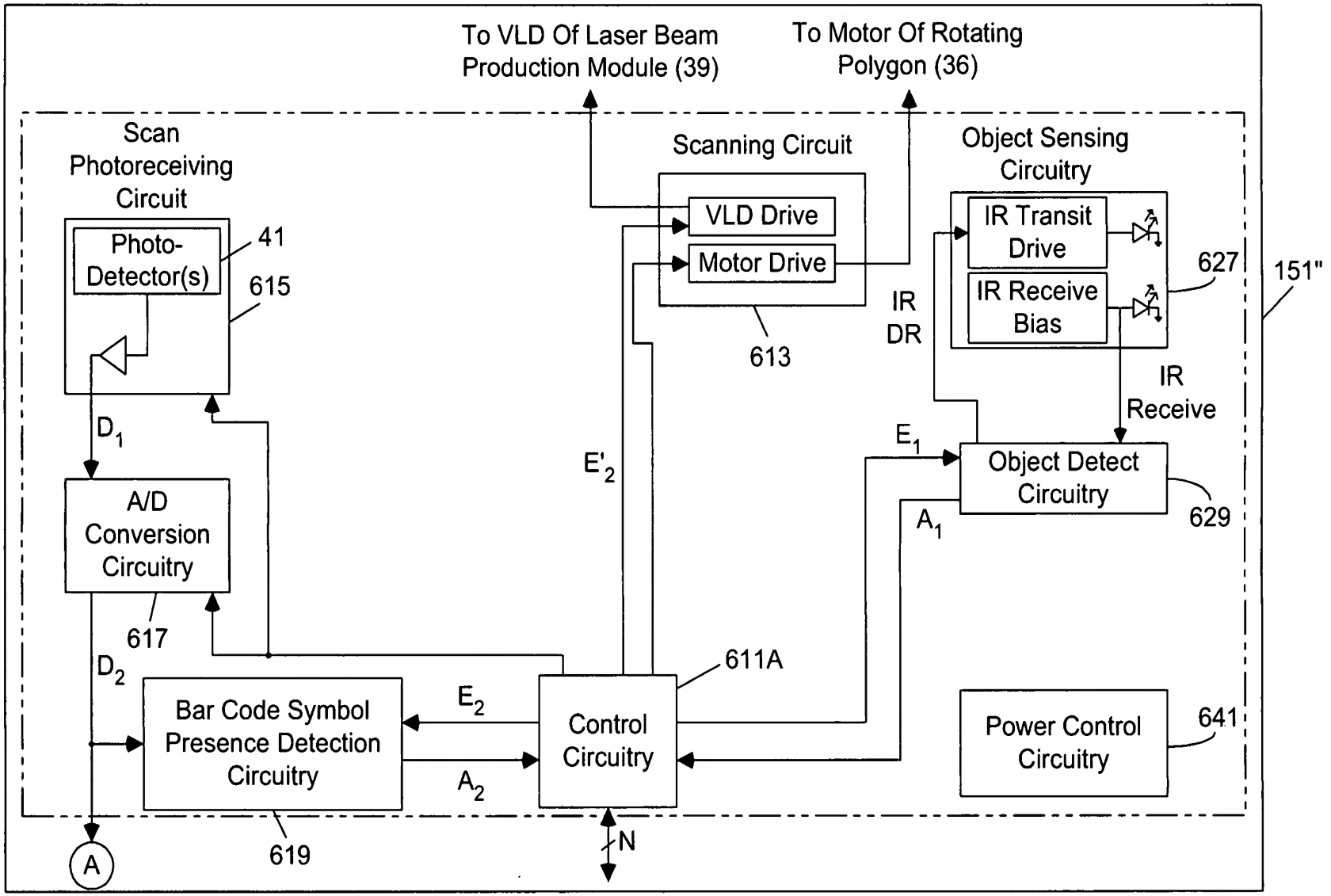
To VLD Of Laser Beam Production Module (39)
To Motor Of Rotating Polygon (36)
Scan Photoreceiving Circuit
Photo-Detector(s)
41
615
Scanning Circuit
VLD Drive
Motor Drive
613
Object Sensing Circuitry
IR Transit Drive
IR Receive Bias
627
151"
IR DR
IR Receive
D_1
E'_2
E_1
Object Detect Circuitry
629
A_1
A/D Conversion Circuitry
617
D_2
611A
E_2
Bar Code Symbol Presence Detection Circuitry
Control Circuitry
Power Control Circuitry
641
A_2
619
N
A

FIG. 15A

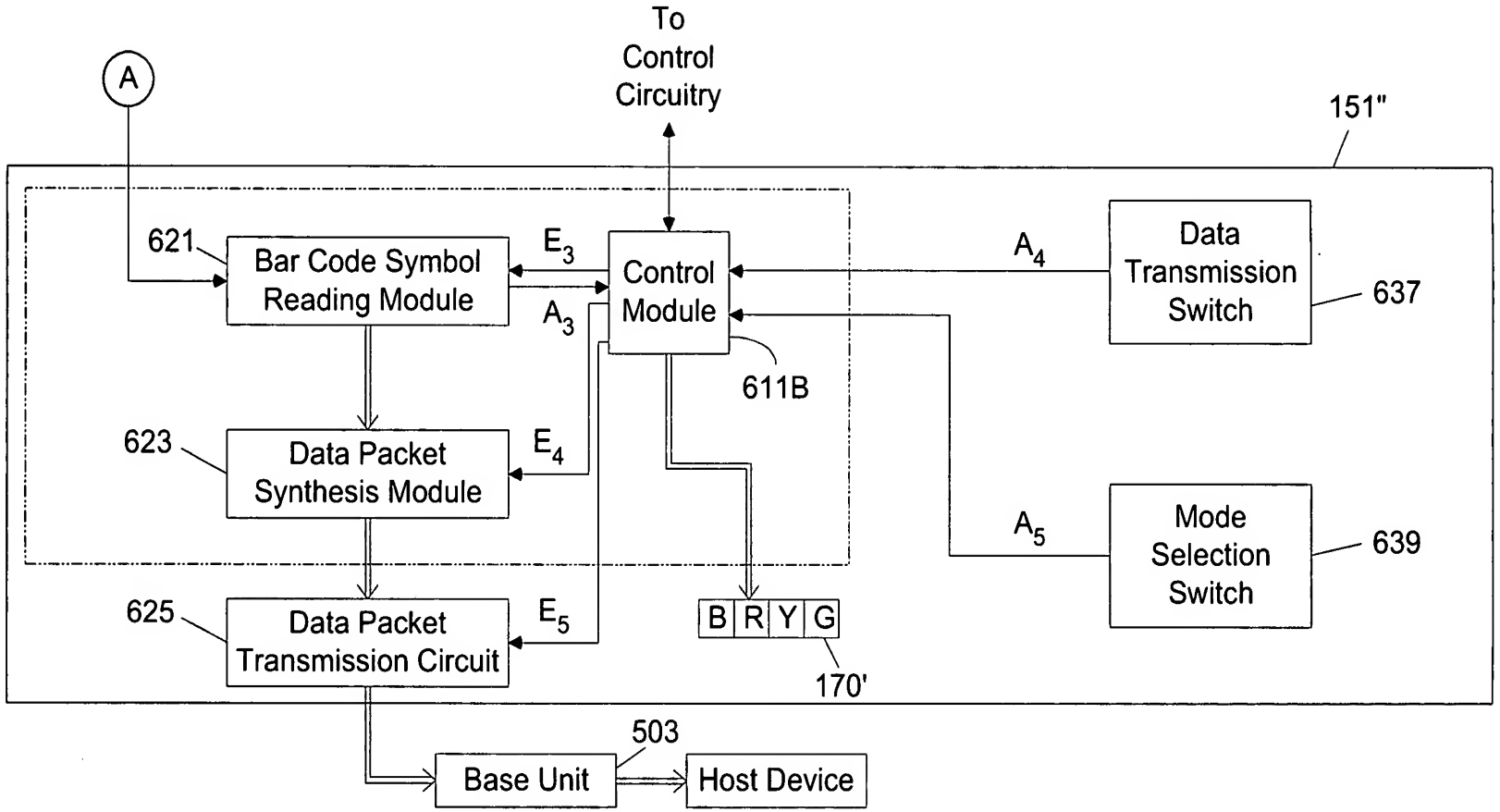
To
Control
Circuitry
A
151"
621
Bar Code Symbol
Reading Module
E3
A3
Control
Module
611B
A4
Data
Transmission
Switch
637
623
Data Packet
Synthesis Module
E4
A5
Mode
Selection
Switch
639
625
Data Packet
Transmission Circuit
E5
B R Y G
170'
503
Base Unit
Host Device

FIG. 15B

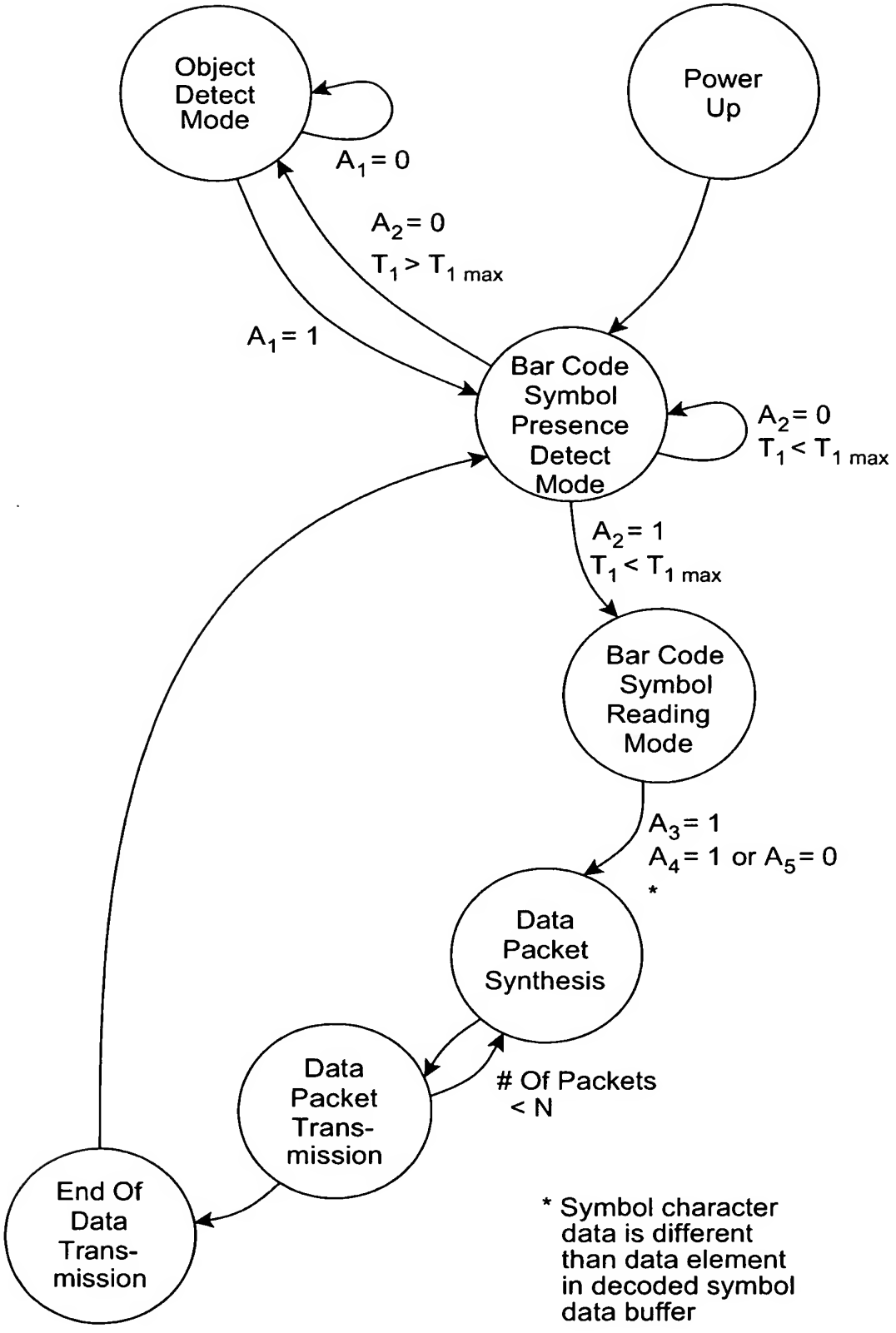
Object Detect Mode
Power Up
$A_1 = 0$
$A_2 = 0$
$T_1 > T_{1\ max}$
$A_1 = 1$
Bar Code Symbol Presence Detect Mode
$A_2 = 0$
$T_1 < T_{1\ max}$
$A_2 = 1$
$T_1 < T_{1\ max}$
Bar Code Symbol Reading Mode
$A_3 = 1$
$A_4 = 1$ or $A_5 = 0$
*
Data Packet Synthesis
Data Packet Trans-mission
Of Packets < N
End Of Data Trans-mission
* Symbol character data is different than data element in decoded symbol data buffer

FIG. 16